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The Duality of Dual Enrollment: How The Relationship between Student Demographics, Academic Metrics, and College Enrollment Adds Up

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THE DUALITY OF DUAL ENROLLMENT: HOW THE RELATIONSHIP BETWEEN STUDENT DEMOGRAPHICS, ACADEMIC METRICS, AND COLLEGE ENROLLMENT ADDS UP

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Dedication

In loving memory and in honor of my dear friend and fellow sojourner, Erika Lynn Grant Poindexter, who modeled grace and strength, and had a delightful charm and tremendous resolve through some of life's most painful circumstances.

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It takes a village…and I have a wonderfully awesome village.

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I am not ending this part of my journey with the same network of support with which I began. But I have a greater appreciation for and a richer experience that "life is better connected." And I am grateful for the beauty and messiness that a connected life entails.

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ABSTRACT

Dual enrollment (DE) programs provide high school students the opportunity to earn credit for college coursework completed while still in high school and help smooth the transition from high school to college by making the unfamiliar familiar—a valuable experience for students from a wide range of economic and academic backgrounds. Yet, the value of DE is largely undermined when students who have completed college credits do not enroll in college after high school graduation. Therefore, this study examined student demographics and academic metrics of Virginia DE students to explore potential patterns between student habitus and college enrollment, providing prototypical profiles of Virginia DE students who immediately enrolled in college, delayed enrollment, or did not enroll. Overall, the data demonstrated that participants of Virginia DE experienced high enrollments in college, but the majority of these students were non-minority, non-first generation, academically high performers, and/or from families with higher income. African American students, Hispanic students, and first generation college students participated in Virginia DE and enrolled in postsecondary education at rates lower than expected given their representation in higher education today, revealing the need to improve policy and practice to better attract and retain these students in DE. This study underscores the need for policymakers and educators to better leverage DE programs to prepare a broader range of students for success in college rather than simply providing courses to those students already primed to attend college and succeed.

Keywords: college enrollment, community college, dual enrollment, dual credit

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CHAPTER 1: INTRODUCTION

The unique position of America's community colleges, situated between secondary and other postsecondary institutions, presents a strategic opportunity to support a broad base of students. The colleges' position renders them a "logical partner" and "integral collaborator" for helping students with the transition from high school to college (Bragg, 2011, p. 366). Further, dual enrollment (DE) programs, which provide high school students the opportunity to take college courses, emerged as a linchpin for building collaborative partnerships among K-12, postsecondary, and business and industry sectors (Amey, Eddy, & Ozaki, 2007; Bragg, 2011; Cohen, Brawer, & Kisker, 2013). When these various stakeholder groups work together to build collaborative arrangements, such as DE programs, stakeholder expectations are often better articulated and aligned (Bailey & Karp, 2003; Jenkins, 2011; Roach, Vargas, & David, 2015). Better alignment across these educational and workforce sectors is critical for developing clearer and stronger college and career pathways for students (Bailey, Jaggars, & Jenkins, 2015).

Dual enrollment programs help improve access to and success in postsecondary education by exposing high school students to the academic expectations of college. These early college experiences can ease the transition from high school to college by providing students the opportunity to learn the role of a college student, acquire academic and social skills for success in college, engage in rigorous and challenging coursework, build confidence in their ability to succeed in college, and acquire a discounted tuition

rate or even free college classes (Barnett & Stamm, 2010; Kanny, 2015; Karp, 2012; Karp & Jeong, 2008). In order to evaluate the true impact of short-term and long-term results of DE programs, it is important to understand who is participating in these course options and to determine the metrics of success in these programs. These metrics include the number of credits earned by participating students, the types of courses they take, their grade point average in DE courses, and how students use their DE credits.

Background

Since the mid-20th century, a high school education in America has been the finish line for movement into a life-long career (Carnevale, Smith, & Strohl, 2013). However, as career options and opportunities have evolved in the new millennium, this end goal is no longer sufficient for well-paying job opportunities and some postsecondary education is now required, making the high school diploma a starting point versus a finish line. In 2012, more than half (54%) of all jobs in America required some education beyond high school, but not necessarily a bachelor's degree (National Skills Coalition, 2014). Yet, the available labor force that was educated and skilled for these "middle-skill" jobs was less than the demand (44%; National Skills Coalition, 2014, p. 1). A gap exists between market demand for skilled labor and educational levels or experiences of those looking for work.

Community colleges are in a strategic position to develop the workforce needed to meet employer demands primarily because they broaden educational access to a wide variety of students and provide the level of postsecondary education and credentials required for middle-skill jobs and the ability for students to transfer to complete a four-year degree. With 45% of all undergraduates in the United States enrolled in community

colleges (U.S. Department of Education [USDOE], 2014), it is apparent that these educational institutions play a critical role in educating America's workforce—a role that has been articulated as part of the national public agenda, especially in recent years (Obama, 2009; The White House, Office of the Press Secretary, 2015b).

Community colleges provide educational opportunities to a diverse range of students, especially those commonly underserved in higher education—students from economically, culturally, educationally, or even socially underprivileged backgrounds—and historically, less likely to cross the finish line of degree completion (Cohen et al., 2013; Malcom, 2013). Yet, as higher education institutions are held to greater levels of accountability, the public agenda is shifting its focus from student *access* to student *success* (American Association of Community Colleges [AACC], 2015; Bragg & Durham, 2012; Stratford, 2013; The White House, Office of the Press Secretary, 2015a). For community colleges, this means it is no longer enough to bring students through the front door of postsecondary education, but it is also important to support them through to completion. This goal requires careful attention to students' pathways into postsecondary education and to the leaks in the educational pipeline where students discontinue their postsecondary journey before earning a postsecondary award or transferring to a four-year institution (Bailey et al., 2015; Bragg, 2011; Karp, 2013; Perna & Thomas, 2006; Rassen, Chaplot, Jenkins, & Johnstone, 2013). Specifically, community colleges are exploring ways to strengthen the transition between high school and college to help students successfully complete their postsecondary education. One strategy to ease the transition from high school to community college is through dual enrollment programs.

Dual enrollment programs are "collaborative efforts between high schools and colleges through which high school students are permitted to enroll in college courses" (Karp & Jeong, 2008, p. i). A benefit of DE for students who go to college after high school graduation is that students begin their college careers having already accumulated college credits. Research indicates that college students who earn at least 20 credits within their first year of college are more likely to persist in postsecondary education and make it to graduation compared to students earning less than 20 credits (Adelman, 2006). Although DE programs have been gaining popularity over the last 30 years, these programs have now expanded as policymakers and educators see them as a key strategy for better preparing high school students for college-level work and helping them transition successfully to college environments (Jobs for the Future, 2006; Karp, 2012, 2015).

Traditionally, DE programs have benefited "high-achieving college-bound" students, providing them the opportunity to get a head start on their college education (Bailey & Karp, 2003, p. vii) and ultimately helping them save time and money in earning a college degree (Johnson & Brophy, 2006; Westcott, 2009). Several researchers have studied the academic outcomes of DE students, such as college enrollment, grade point average in college, and degree attainment (Allen & Dadgar, 2012; An, 2015; Bailey & Karp, 2003; Carter, 2009; Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Crouse & Allen, 2014; Hughes, Rodriguez, Edwards, & Belfield, 2012; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Pretlow & Wathington, 2014; Taylor, 2015). In these studies, students who participated in DE were more likely to enroll in

college, earned higher grades, and were more likely to earn a college degree than students who did not participate in DE.

As of late, however, the opportunity to participate in DE programs has been extended to students from a wider variety of academic backgrounds (i.e., middle- to lower-performing students), and even those who may be high-achieving yet have little to no knowledge or expectations of the college environment, such as students who are the first in their families to attend college (Bailey & Karp, 2003; Hoffman, Vargas, & Santos, 2008; Kanny, 2015; Pretlow & Wathington, 2014). As access to DE programs has expanded to include students from a variety of academic and economic backgrounds, the ways in which these programs are designed and implemented have also evolved, recognizing that some students require more structure and support than what traditional DE programs offer (Barnett & Stamm, 2010; Hughes et al., 2012). In these later variations, DE programs are more comprehensive in the level of intensity and support provided to students (e.g., structured curriculum and targeted student support services) to maximize students' potential for success (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett & Stamm, 2010; Barnett, Maclutsky, & Wagonlander, 2015). Variations in the design and implementation of DE programs are discussed in more detail in Chapter 2.

Similar to the programmatic structure of DE programs changing to serve a broader range of students, recent research efforts have also started paying specific attention to program outcomes for these targeted student populations—students from minority backgrounds, from families with lower income, with parents who did not attend college, and who are academically underprepared. Researchers have started examining outcomes across different student populations to determine whether students benefit

equally from participating in DE programs (An, 2013; Cowan & Goldhaber, 2015; Pretlow & Wathington, 2014; Roach et al., 2015; Taylor, 2015). Despite the benefits that DE programs provide some students, researchers have found less consistent results when controlling for student characteristics such as race/ethnicity, socioeconomic status, or previous academic achievement. These findings reveal some inequities in the benefits of DE programs for diverse student populations. Further, researchers examining the impact of DE programs on college enrollment have consistently found that participation in these programs does not guarantee that students will actually enroll in college (Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Davenport, 2013; Hughes et al., 2012; Karp et al., 2007; Pretlow & Wathington, 2014), which undermines the potential impact of these programs on college completion.

Providing greater access to DE programs for a wider variety of students has not necessarily equated to greater success for these students. This outcome indicates a need to better understand who participates in and benefits from these programs. The extant literature provides neither a consistent demographic profile of DE students nor disaggregates the benefits diverse students experience relative to their participation in DE. The structure and context of DE programs contribute to student participation in DE, as well as outcomes regarding college attendance (Hughes et al., 2012). Studying DE programs within a defined context to assess participation and outcomes can provide more insight into DE program characteristics that contribute to student success and to student college-going behaviors. Similarly, individual student characteristics (e.g., demographics and academic metrics) and contextual factors (e.g., state and institutional policies) have also been shown to influence student college enrollment (Hahn & Price, 2008; Martinez

& Klopott, 2005; Perna, 2006). It remains unclear, then, who is participating in DE and of those participating who enrolls in postsecondary education after high school graduation. As well, DE needs further investigation from the perspective of policy implications in states with coordinating systems that have more oversight regarding DE programs.

Statement of the Problem

Dual enrollment programs provide high school students the opportunity to earn college credits while in high school (Karp & Jeong, 2008). These programs have been associated with positive outcomes for student participants, accelerating their pathway to a college degree. Yet, not all DE students enroll in postsecondary education—neither in a two-year nor four-year institution—after graduating from high school. As Karp (2015) pointedly stated, students "must enter college, as [they] cannot graduate from an institution [they] never started!" (p. 105). However, it is unknown who among DE students transition into college and who do not. Knowing more about what contributes to college enrollment for DE students is an important first step in being able to build better college and career pathways for all DE students.

High school students are enrolling in college courses through DE programs today more than ever before, making DE students one of the fastest growing student populations in the community college sector. During the 2002-03 school year, 680,000 high school students took college courses through DE programs (Kleiner & Lewis, 2005). By 2010-11, the number of high school DE students was 1,277,000, an 88% increase in student participation (Marken, Gray, & Lewis, 2013). In Virginia, within the same timeframe, DE students more than doubled from 12,579 students to 25,486 (a 103%

increase), and the majority of these DE students were enrolled in a Virginia Community College (State Council of Higher Education for Virginia [SCHEV], 2015c). Nationally, 71% of DE students participate in programs provided by public two-year institutions (Marken et al., 2013). In Virginia, this level of participation is higher with 96% of DE students enrolled in one of Virginia's 23 community colleges (SCHEV, 2015c), reaffirming the relevant role community colleges play in DE partnerships. The remaining 4% of Virginia's dual enrolled students participated in a DE program offered by eight public four-year institutions and one junior college within the Commonwealth (SCHEV, 2015c). These figures call attention to this growing student population for Virginia policymakers and educators interested in improving access to and success in postsecondary education.

For some students, successfully completing college-level coursework in high school may be the only postsecondary education they require for specific career pathways. For others, additional education after high school graduation may be needed. Although participation rates in DE programs appear to be significant and previous studies have revealed several benefits DE programs provide some students, we know that not all DE students enroll in college after graduating from high school. The fact that some students have credits, but do not enroll in college may indicate a missed opportunity for the students and for employers who need skilled employees. In Virginia, as many as 36% of students who participated in DE did not enroll in college in the semester following high school graduation (Davenport, 2013). Research has indicated that delaying enrollment into college is associated with lower persistence and completion rates (Adelman, 2006; Bozick & DeLuca, 2005). These data indicate that almost 4 out of 10

students do not experience the full benefits of dual enrollment because they do not enroll in college immediately after high school. What remains unknown about DE students who do not matriculate into postsecondary education are their demographics (e.g., gender, race/ethnicity, parents' educational attainment) and their academic metrics in DE courses while in high school (e.g., grade point average in dual enrollment courses, number of credits attempted and completed). Moreover, research does not track whether these former DE students eventually enroll in college.

Policymakers and educators will have a difficult time addressing issues of access and success without understanding who is participating in DE programs and knowing which characteristics are associated with DE students who enroll, delay enrollment, or do not enroll in postsecondary education after high school graduation. Herein lies the current gap in the research that this study plans to address. In this study, I conducted a quantitative analysis of the demographics and academic metrics of students in Virginia who participated in DE in high school and immediately enrolled, delayed enrollment, or did not enroll in college following high school graduation to better understand if there are links among these variables and student choices regarding pursuit of postsecondary education.

Statement of the Purpose

Given the growth of participation in DE programs and the diversity of students believed to be participating in and benefiting from these programs, the purpose of this study was to understand which student demographics and academic metrics influenced postsecondary educational pathways for high school graduates who participated in DE in Virginia's Community Colleges. Further, this study investigated the predictability of

student demographics and academic metrics on student non-enrollment in postsecondary education.

When students do not actually enroll in college, DE programs are not effective in achieving the goal of smoothing the transition from high school to college, helping prepare students for the academic rigors of a college education, or giving them a head start on earning college credits. Understanding who these students are who do not enroll in college after participating in DE would help institutions identify whether this lack of enrollment represents a leak in the educational pipeline—students do not transition from one phase to the next as anticipated—or whether students are successfully completing their postsecondary education requirements and no longer require additional education. Dual enrollment programs are intended to help students access and succeed in postsecondary education, yet in Virginia it is unknown who actually is taking advantage of this pathway. Examining student data in DE programs and potential predictor variables will help illuminate patterns in college enrollment that can inform ways to clarify and strengthen college and career pathways for all DE students, close the educational achievement gap, and build a stronger workforce.

Research Questions

This study was guided by the following research questions:

1. What are identified student demographics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?

a. How are student demographics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?
b. How are student demographics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?
c. How are student demographics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?

2. What are identified academic metrics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?
    a. How are academic metrics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?
    b. How are academic metrics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?
    c. How are academic metrics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?
3. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of non-enrollment?

a. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of delayed enrollment?
b. Do identified school-level characteristics predict the rate of non-enrollment?

Conceptual Framework

Dual enrollment programs provide a bridge to postsecondary college enrollment (Fisher & Abbott, 2011), but not all DE students take this pathway. With a more diverse student population enrolling in DE programs today and a significant portion of them enrolling in these programs at community colleges, policymakers and educators should seek to identify and understand the factors influencing the postsecondary educational pathways of these students. Although community colleges have broadened access to postsecondary education for students from a variety of economic and academic backgrounds (Cohen et al., 2013; Malcom, 2013), barriers to higher education still exist for some students. By design, DE programs can address some of these barriers by exposing students to the demands and expectations of college-level coursework and thus, better preparing them to succeed in college (Karp, 2012). These programs also provide a more enriched high school curriculum, reduce college costs to students with low or no-cost DE courses, and can even shorten the time to a degree (Cowan & Goldhaber, 2015; Johnson & Brophy, 2006; Swanson, 2008; Westcott, 2009). However, not all students who have participated in DE continue their education right after high school graduation.

In order to better understand the factors influencing students' choice to enroll in college, Perna (2006) developed a robust conceptual model for studying student college

choice, recognizing the need to consider college choice from multiple theoretical perspectives. According to Perna (2006) and building upon previous research, student college choice involves multiple layers whereby students make "decisions about whether or not to attend college and decisions about which particular college to attend" (p. 102). Specifically, Perna (2006) identified four layers that influence a student's choice to enroll in college: individual habitus; school and community context; higher education context; and social, economic, and policy context (Figure 1).

The first layer for college choice, individual habitus, involves characteristics of the individual student as well as family background characteristics that have been associated with college-going behaviors, such as knowledge and value of college attainment, and information about and assistance with college (Hahn & Price, 2008; Martinez & Klopott, 2005). Therefore, these characteristics are important in understanding the pathways of DE students because they are likely to influence their decision to enroll in college.

The next three layers in Perna's (2006) model are contextual and include factors that are external to the student, yet still potentially influential to a student's decision to enroll in college. These contextual layers include the school and community context; the higher education context; and the social, economic, and policy context. Within these three layers, Perna (2006) identified factors that influence student college choice, such as programs and services oriented toward college (school and community); financing college (higher education); and societal demographics, labor market, and policies and structures that promote or hinder college enrollment (social, economic, and policy).

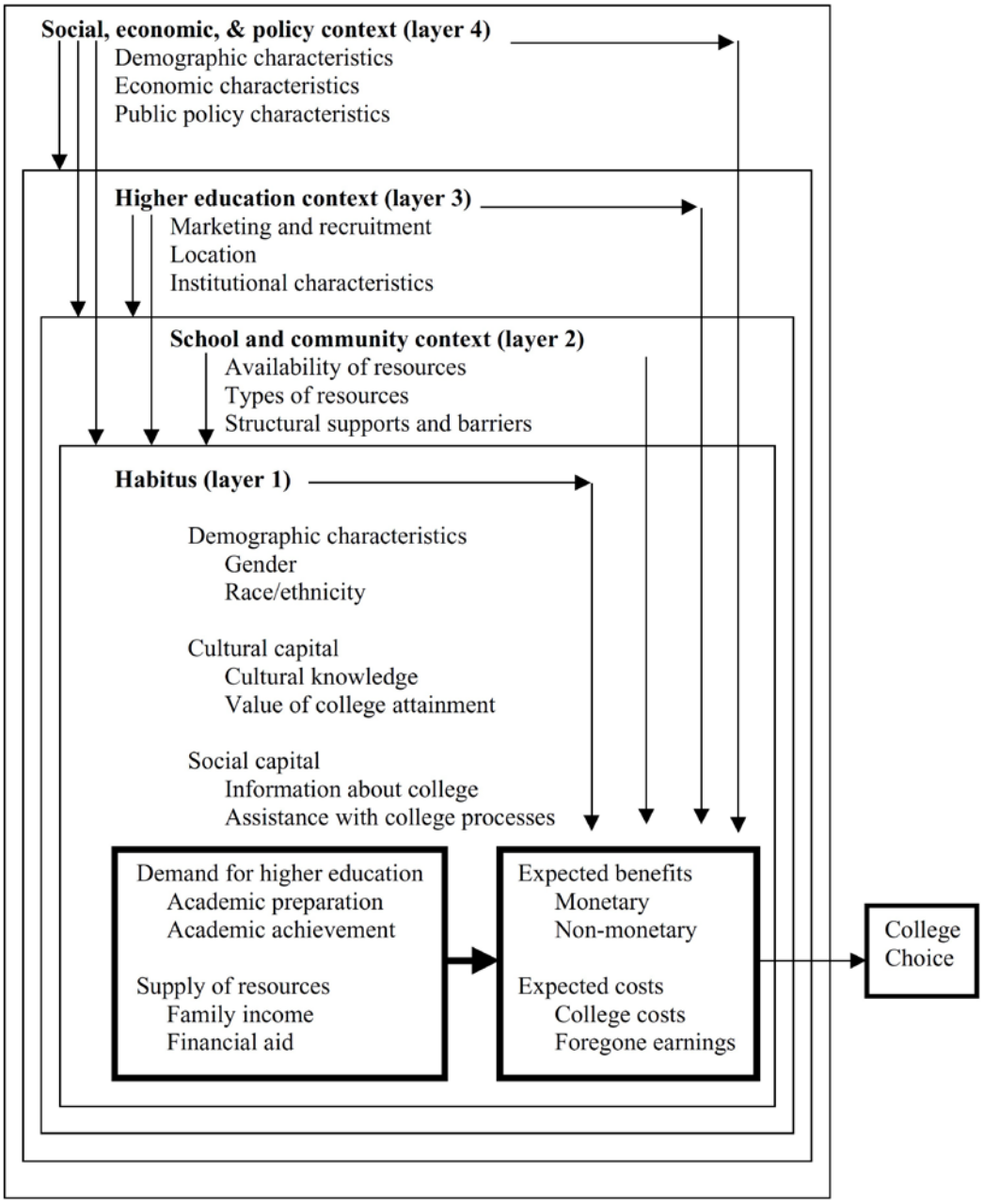

Figure 1. Conceptual Model for Student College Choice. Adapted from "Studying college access and choice: A proposed conceptual model," by L. Perna, 2006, *Higher Education: Handbook of Theory and Research, XXI,* p. 117

The utility of Perna's (2006) college choice model for studying the college enrollment patterns of DE students is attributed to elements within each of the four layers that influence the design and implementation of DE programs. For example, state and/or

institutional policies shape how DE programs are structured in terms of program objectives, target audience, courses offered, funding, and program activities. These variations in program structures affect who participates in and how they benefit from these programs (Hughes et al., 2012). The context in which DE programs are delivered was important for analyzing the data because it provided the backdrop for analysis.

For this study, I make use of Perna's (2006) model in a dual fashion: (1) in the organization of the literature review in the following chapter as it pertains to the factors influencing college enrollment, and (2) homing in on the first layer of individual habitus as the framework for analysis and discussion. I focused primarily on the individual characteristics of Virginia DE students and their potential relationship with postsecondary educational pathways because it has not been researched before. It is important to understand these relationships first before looking into the potential influence of factors in the other layers, such as school and community factors. Therefore, for the purpose of this study, I explored the factors within the first layer (i.e., individual habitus) as well as built the overall context of Virginia's DE programs using the three contextual layers when investigating potential relationships to DE students who enroll, delay enrollment, or do not enroll in postsecondary education.

Significance of the Study

In 2014-15, Virginia's Community Colleges delivered DE courses to 27,593 high school students (SCHEV, 2015c). For these institutions, DE students accounted for 15% of full-time equivalent (FTE) students (SCHEV, 2015d). These enrollment figures were up from those 10 years ago in 2004-05 when 17,746 high school students took a dual enrollment course from the VCCS, which then accounted for 12% of all VCCS students

(SCHEV, 2015d). This growth equated to 9,837 more students participating, or a 55% increase, within a 10-year period (SCHEV, 2015d). The sheer volume of students participating in DE programs in Virginia, as well as the growing participation rates, suggests the need for a deeper understanding of who is participating in these programs, how they are benefitting from these programs, and whether identified characteristics of students (i.e., demographics and/or academic metrics) predict who enrolls in postsecondary education after graduating from high school. It is clear that the DE student population is comprising a greater percentage of students enrolled in Virginia's Community Colleges, which has fiscal implications for the colleges and academic implications for academic programs and student learning. Further, this enrollment trend advocates the opportunity for educational institutions to build stronger transitions between secondary and postsecondary education, and a need for better understanding of the factors that contribute to non-enrollment.

With a greater demand for more Americans to receive postsecondary education and training (Carnevale et al., 2013), one potential strategy for meeting this demand is through participation in DE programs (Krueger, 2006). Because there is a growing number of jobs requiring some education beyond high school, but not necessarily a bachelor's degree (National Skills Coalition, 2014), students taking DE courses in high school have the opportunity to acquire the required training for these middle-skill jobs while still in high school. Thus, the utility of DE programs is that they can prepare students for multiple college and career pathways: either more education at a two- or four-year institution or for entrance into the workforce.

Although researchers have reported greater college enrollment rates for students who took DE courses in high school than those who did not take DE courses (Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Hughes et al., 2012; Karp et al., 2007; Pretlow & Wathington, 2014; Taylor, 2015), this quantitative analysis brought to light the potential differences among DE students who immediately enrolled, delayed enrollment, and did not enroll in college after high school graduation. It is important to mention, however, that this type of analysis can only reveal differences across these variables and measure their association; it cannot infer the cause or reason for these differences (Gall, Gall, & Borg, 2007).

Method Summary

This study utilized descriptive and inferential statistics to examine the differences in student habitus (i.e., student demographics and academic metrics) among high school students who participated in DE and either subsequently enrolled, delayed enrollment, or did not enroll in college. Logistic regression analysis was also used to investigate the predictability of student demographics and academic metrics on enrollment in college, and then, the predictability of immediate or delayed enrollment (Albright & Marinova, 2010; Warner, 2013).

The population of study was delimited to the Commonwealth of Virginia and specifically to DE courses offered by Virginia's Community Colleges to help establish contextual boundaries around the policies and programmatic structure of DE programs in Virginia. Virginia was selected because the primary provider of DE programs is the state's community college system. This statewide DE program is governed by the *Virginia Plan for Dual Enrollment* (VPDE or Virginia Plan as used in this study), which

offers a common policy framework and a rich source of student data for the state's 23 community colleges.

Further, this study focused on the timeframe following the 2008 revisions to the Virginia Plan. It was assumed that the 2008 Virginia Plan was operationalized by participating institutions by fall 2008. Therefore, the academic years between fall 2008 and spring 2012 were used for this study to include high school students who graduated in spring 2012 and enrolled in at least one dual enrollment course offered by a Virginia Community College from the time they likely entered high school as a freshman in fall 2008.

Two sources of data were requested from the Virginia Community College System (VCCS) for this study: (1) dual enrollment data to capture participation for seniors graduating high school in spring 2012 who participated in DE as early as fall 2008, and (2) postsecondary enrollment data to include information about the 2012 high school graduates who immediately enrolled (enrolled by fall 2012), who delayed enrollment (enrolled by fall 2013, 2014, or 2015), and who did not enroll in college. Although the postsecondary enrollment data originates from the National Student Clearinghouse, the VCCS purchases this data for its own research purposes and matches postsecondary enrollment data with its own student data to track students' progress in college.

Definitions of Terms

The following definitions of key terms are used for this study:

Academic metrics refer to a collection of research variables that describe a student's participation and performance in dual enrollment, including the first term

student enrolled in dual enrollment, the total number of terms enrolled in dual enrollment, total dual enrollment credits attempted, total dual enrollment credits completed, the number of dual enrollment credits attempted and completed per year, the number of college transfer dual enrollment credits attempted and completed, the number of career/technical education (CTE) dual enrollment credits attempted and completed, grade point average in dual enrollment courses, and award earned from community college.

Career/technical education (CTE) refers to programs "designed to help meet the increasing demand for technicians, semiprofessional workers, apprentices, and skilled crafts persons for employment in industry, business, the professions, and government. These programs normally require two years or less of training beyond high school. They may include preparation for agricultural, business, engineering, health and medical, industrial, service, and other technical and occupational fields" (VCCS, 2017a, para. 2).

College choice refers to the multi-phase process whereby students make "decisions about whether or not to attend college and decisions about which particular college to attend" (Perna, 2006, p. 102).

College transfer education "include courses the first two years of a baccalaureate program in arts and sciences and preprofessional programs meeting standards acceptable for transfer to baccalaureate degree programs. These programs shall be of equal content and quality to those provided in the four-year, degree-granting institutions to facilitate the transfer of students from the community college to four-year colleges and universities" (VCCS, 2017a, para. 3).

Delayed postsecondary (college) enrollment refers to an outcome measured in this study as a student not enrolled in any postsecondary institution—either a two-year or

four-year institution—right after high school graduation (i.e., by fall 2012) but eventually enrolled between spring 2013 and fall 2015.

Dual enrollment or *DE* refers to "community college coursework taken by high school students…wherein a student takes college-level coursework that counts towards high school graduation and is designed to result in earned college credits" (VCCS, 2015b, p. 1).

Early/Middle college high school refers to "schools [that] are products of partnerships between school districts and postsecondary institutions. …often located on college campuses and, in the case of early colleges, are designed to allow students to graduate from high school with an associate degree or 1-2 years of college credit. This educational design frequently targets students underserved in college, and, therefore, provides varied kinds of supports to help students to succeed in their college classes" (Barnett & Stamm, 2010, p. 4).

Immediate postsecondary (college) enrollment refers to an outcome measured in this study as a student enrolled in any postsecondary institution—either a two-year or four-year institution—right after high school graduation (i.e., by fall 2012).

Postsecondary education refers to "some kind of formal education or training after high school in a postsecondary institution that leads to a credential or degree" (Chait & Venezia, 2009, p. 3). The terms postsecondary education, college, and higher education are used interchangeably in this study.

Postsecondary (college) enrollment refers to an outcome measured in this study as a student enrolled in any postsecondary institution—either a two-year or four-year institution—at any time between fall 2012 and fall 2015.

Postsecondary (college) non-enrollment refers to an outcome measured in this study as a student not enrolled in any postsecondary institution between summer 2012 and fall 2015.

Student demographics refer to a collection of research variables that includes gender, race/ethnicity, age at enrollment in first dual enrollment course, first generation college student indicator, and percentage of students at high school receiving free and reduced-price lunch.

Virginia Community College System or *VCCS* refers to the Commonwealth of Virginia's system of 23 community colleges across 40 campuses and a central administrative office.

Virginia Plan for Dual Enrollment or *VPDE* or *Virginia Plan* refers to the signed agreement between Virginia's Secretary of Education, Superintendent of Public Instruction, and Chancellor of the Virginia Community College System providing the "state-wide framework for dual enrollment arrangements between the public schools and community colleges" (VCCS, 2008).

Summary

Providing high school students the opportunity to earn college credit through DE programs can smooth the transition into postsecondary education for DE participants. Dual enrollment programs can also help improve the college-going rates of students from a variety of academic and economic backgrounds. However, as the literature review demonstrates, we often make assumptions about high school students who take college courses through DE programs. We make assumptions about their academic preparation and achievement, their educational aspirations and goals, and their readiness for college

and the workplace (Fisher & Abbott, 2011; Speroni, 2012). And these assumptions might not be true. Consequently, it is important to learn more about DE students as they might be considered a marginalized student population that deserves further attention.

This study begins to explore these assumptions in order to better understand who our DE students are in the Commonwealth of Virginia, which will help build stronger and clearer college and career pathways for these students. In Chapter 2, the literature review is organized to closely follow Perna's (2006) model of student college choice, highlighting the factors influencing college enrollment. The literature review also frames the contextual factors that influence the structure and implementation of DE programs, connecting these to college enrollment and also to DE students. Chapter 3 outlines the research design, methods, and variables, justifying the need for disaggregating the data in order to understand who is participating in DE programs and the outcomes for these participants. In Chapters 4 and 5, I present the results of the research and discuss the contributions to the extant literature and implications on practice, policy, and future research.

CHAPTER 2: REVIEW OF LITERATURE

Early models of dual enrollment (DE) programs provided an attractive opportunity for "high-achieving college-bound" students to get a head start on earning college credits while in high school (Bailey & Karp, 2003, p. vii). At the turn of the 21st century, DE programs started targeting a broader range of students (i.e., middle- to lower-performing students) and further research was needed to ensure programmatic benefits were distributed evenly among these students from various academic and economic backgrounds (An, 2013; Bailey & Karp, 2003; Cowan & Goldhaber, 2015; Pretlow & Wathington, 2014; Roach et al., 2015; Taylor, 2015). Consequently, as access to DE programs broadened, researchers started to investigate how broader access related to student success (e.g., college enrollment, grade point average, completion, etc.) in DE programs. Now that a broader range of students are participating in DE programs, it is important to assess how all DE students are performing in and benefitting from these programs. Although some researchers have started to explore in other states how more open access to DE programs might result in differential outcomes across student demographics, similar research is needed for DE programs within the Virginia context. Thus, this study explores the potential differences among Virginia DE students and their postsecondary educational pathways.

The purpose of this study was to understand which student demographics and academic metrics influenced postsecondary educational pathways for high school

graduates who participated in dual enrollment in Virginia's Community Colleges. Further, this study investigated the predictability of student demographics and academic metrics on student non-enrollment in postsecondary education. Specifically, this study explored the college enrollment patterns of Virginia DE students to determine whether there were differences among those who enrolled in college, delayed enrollment, or never enrolled in postsecondary programs. This research helps address such questions as: Do students in each postsecondary education enrollment category share similar characteristics in terms of student demographics and/or academic metrics? Were they qualified for college-level work based on their performance in DE courses? Did they earn a postsecondary credential before graduating high school?

This chapter is organized into three major sections to (1) present the literature on factors that influence a student's choice to enroll in college, (2) emphasize how DE programs prepare high school students for college, and (3) illustrate this study's theoretical framework for exploring the relationship between student habitus and the postsecondary educational pathways of students in Virginia DE programs. In the following sections, I first outline Perna's (2006) student college choice model, describing the social, economic, and policy context; the higher education context; the K-12 school context; and student habitus as they relate to college enrollment patterns. In the next section, I illustrate where these layers converge with the program design for DE programs, and highlight several program components that are related to each of Perna's (2006) contextual layers. Relevant literature examining the benefits of DE programs for students from a variety of academic and economic backgrounds is also provided. In the third section, I conclude with a discussion of the theoretical framework used to design

this study, introducing a proposed model for understanding the relationship between student demographics and academic metrics (i.e., student habitus) and the college enrollment patterns of Virginia DE students. I also present a primer of DE in Virginia, recognizing Virginia's Community Colleges as the state's primary provider of DE programs.

Student College Choice: Factors that Influence College Enrollment

Today a larger percentage of 18- to 24-year olds are enrolled in college than four decades ago (25% in 1974 compared to 40% in 2014; USDOE, National Center for Education Statistics [NCES], 2014a). Economic indicators point to postsecondary education and training as a vehicle for social mobility (Baum, Ma, & Payea, 2013; Pew Research Center, 2014; USDOE, 2006), yet three out of 10 high school seniors do not enroll in college after high school graduation (Bureau of Labor Statistics, U.S. Department of Labor, 2015). These college enrollment figures challenge policymakers, administrators, and educators to understand which factors influence students' postsecondary educational pathways and further explore which students are immediately enrolling, delaying enrollment, or not enrolling in postsecondary education.

Researchers have studied how public policy, institutional policies and practices, and students and families (e.g., family income, social status, information about higher education, value of higher education) help shape student college choice (Chait & Venezia, 2009; Hahn & Price, 2008; Kinzie et al., 2004; Tierney, Colyar, & Corwin, 2003). Perna (2006) identified and categorized individual characteristics and environmental, or contextual, factors into four layers in her student college choice model, recognizing that several factors might sway a student's decision to go to college.

The organization of this section mirrors Perna's (2006) college choice model (see Figure 1), which is composed of four layers that directly and indirectly influence an individual's choice to enroll in college: 1) the broader social, economic, and policy context; 2) the higher education context; 3) school and community context; and 4) the individual's habitus. In this section, I introduce each of these layers, explaining their influence on college enrollment.

The social, economic, and policy context: The value of higher education (Layer 4). The broadest contextual layer of Perna's (2006) student college choice model focuses on the social, economic, and policy context. This contextual layer includes societal demographics (e.g., perceived and actual value of a college education), labor market demands (e.g., need for education), and higher education policies and funding structures (e.g., admissions, tuition, and financial aid).

Social context. The value society places on postsecondary education can influence a student's choice to enroll in college as individuals recognize the opportunity and potential for pursuing education beyond high school (Perna, 2006). Individuals with a postsecondary credential, or at least some postsecondary education, have higher levels of income, are more likely to be employed, and are less likely to live in poverty (Baum et al., 2013; Pew Research Center, 2014). These individual benefits then capitalize into societal benefits when, for example, individuals with higher levels of education earn higher incomes, generating more tax revenue (Baum et al., 2013; Pew Research Center, 2014). These individuals also tend to be more active citizens who engage with their communities by volunteering or voting in elections (Baum et al., 2013).

Although individual and societal benefits of higher levels of education have been well-documented by researchers, not all high school graduates enroll in college. According to the most recent data, 68% of high school graduates across the nation enrolled in a postsecondary institution within four months of high school graduation (Bureau of Labor Statistics, U.S. Department of Labor, 2015). These college enrollment rates indicate an opportunity for policymakers, administrators, and educators to better understand the factors that influence students' postsecondary education pathways, which can then help them better design programs that promote and prepare students for college.

Higher education helps improve social mobility by providing individuals the opportunity to acquire the knowledge and skills needed to secure a higher occupational level and standard of living (USDOE, 2006). Similarly, DE programs are also seen as a "mechanism of social mobility" in the way these programs help prepare students for college-level coursework and ultimately, for earning a postsecondary credential (Taylor, 2013, p. 15). Yet, as discussed later in the chapter, not every DE student enrolls in postsecondary education after high school graduation either (Pretlow & Wathington, 2014). Therefore, this study investigated who does and does not enroll and whether they have characteristics (i.e., demographics and academic metrics) in common.

Economic context. As with the social context, another important contributing factor to a student's choice to enroll in college is the economic value of a college education. In America, the demand for an educated and skilled workforce is greater today than two generations before (McCarthy, 2014). In 1973, only 28% of jobs required some form of postsecondary education and training (e.g., some college, associate degree, bachelor's degree, master's degree or beyond; Carnevale et al., 2013). By 2010, the

demand had more than doubled to 59% of jobs requiring education or training beyond high school (Carnevale et al., 2013). McCarthy (2014), a policy analyst studying postsecondary education and workforce development policy, raised the concern that "the job market for people without postsecondary credentials has collapsed" (p. 5). Despite this economic reality, some individuals do not choose to further their education or training because of direct and indirect costs (e.g., tuition, fees, books, transportation, and living expenses), and even the "opportunity cost" in which an individual forgoes the potential income earned in a job and/or the time spent with family to go to college instead (Hahn & Price, 2008, p. 5).

Other economic research indicates that the demand for educated and skilled workers rivals the available workforce, and for certain levels of education the demand trumps the supply (National Skills Coalition, 2014). For example, in Virginia, "middle skill" jobs—jobs that require some education beyond high school, but not necessarily a bachelor's degree—account for nearly half (49%) of all jobs (National Skills Coalition, 2014, p. 1). The remaining 51% of jobs either requires less than a high school education (15% of all jobs) or a bachelor's degree or more (36% of all jobs). Yet, only 40% of workers are trained for these middle-skill jobs, highlighting a gap between the supply and demand for a skilled workforce in Virginia (National Skills Coalition, 2014). Closing the gap between in-demand jobs and skilled workers available to fill these jobs is critical for building a strong economy and maintaining America's global competiveness (Davies, 2006; Obama, 2009).

Dual enrollment programs can augment postsecondary education initiatives that promote economic development and close the workforce gap. Opportunities for DE have

expanded to include a growing number of career and technical education (CTE) courses, which provide multiple college and career pathways to students (Hughes, Karp, Bunting, & Friedel, 2005; Karp et al., 2007). Through CTE courses, high school DE students can acquire the postsecondary education and training needed for middle-skill jobs (Hughes et al., 2005; Karp et al., 2007). What remains unknown is the extent to which these DE students are enrolling in postsecondary education and whether their enrollment patterns are similar or different from DE students who take other types of DE courses (i.e., transfer courses)—a research variable in this study.

Policy context. Public education policy has shaped the American perception of who should attend college (Hutcheson, 2007), who does attend college (Fowler, 2009), and even the type of institution a student attends (public vs. private, two-year vs. four-year, in-state vs. out-of-state; Perna & Titus, 2004). Perna and Titus (2004) investigated state public policies, specifically exploring the relationship between direct appropriations to institutions of higher education, financial aid to students, tuition, and policies related to academic preparation in K-12 education on college choice and enrollment patterns. Their research further substantiated the recurring theme that higher socioeconomic status encourages college enrollment. Perna and Titus (2004) concluded that public policy should continue to be leveraged to remove barriers to college access for students from diverse economic backgrounds.

The relationship between socioeconomic status and college enrollment, however, exists beyond the financial implications of attending higher education institutions. In addition to economic capital, research has demonstrated how other forms of capital, such as social and cultural capital, also influence who has access to and succeeds in higher

education (Bourdieu, 2011; Kinzie et al., 2004; Martinez & Klopott, 2005). Social capital includes the relationships and networks an individual builds through social interactions, and cultural capital includes the knowledge, skills, and education an individual possesses (Bourdieu, 2011). Bourdieu posited that economic capital could be transformed into the other types of capital, and therefore was at the "root of all the other types" (p. 91). The use of public policy, in helping individuals overcome a deficit in economic, social, or cultural capital is particularly notable in the establishment of public community colleges. Public policy helped establish the community college in order to broaden access by making higher education more affordable and providing a college and career pathway for individuals who might not be ready for a traditional four-year experience (Meier, 2013). In this way, public policy was used to improve the capital deficit of individuals by providing higher education opportunities through public community colleges. Community colleges help eliminate academic and financial barriers through low-cost tuition and open access practices, which include year-round enrollment and fewer eligibility requirements for admissions. Broad access and affordability have resulted in a more diverse student body at community colleges as students find these institutions to be more within their reach in terms of admission requirements and cost (Cohen et al., 2013).

Public policy has shaped the landscape of higher education by expanding access to students from a variety of academic and economic backgrounds to a college education, playing a significant role in helping individuals and society realize the benefits of a higher education. Public policy has also been used to regulate and implement specific programs (e.g., federal financial aid, dual enrollment, TRiO program, Tech-Prep, etc.)

that expand access to and success in postsecondary education. The direct connection between public policy and DE programs is apparent as 46 states and the District of Columbia have statewide policies in place governing these programs (Education Commission of the States [ECS], 2016). These statewide policies vary in their definition and purpose of DE, student eligibility requirements, quality assurance, funding, where courses are taught, and the transferability of college credits (ECS, 2016), which further substantiates the need to investigate data from a single state in order to frame the state's context for DE opportunities.

While social values, economic indicators, and public policy have helped to broaden access to postsecondary education, institutions—both postsecondary and K-12—also play an essential role in helping students pursue their college and career pathways. Through K-12 school institutional policies, practices, and programs, institutions influence student access to and success in postsecondary education (Perna & Thomas, 2006; Rassen et al., 2013; Tinto & Pusser, 2006). Dual enrollment is one initiative institutions use to prepare students for the transition from high school to postsecondary education (Bailey & Karp, 2003; Hoffman et al., 2008; Karp & Hughes, 2008).

Higher education context: The role of community colleges (Layer 3). The higher education context in Perna's (2006) student college choice model positions higher education institutions as "a source of information to students and their families about postsecondary education options" (p. 118), which primarily manifests in how institutions market themselves to prospective students. Perna (2006) further postulated that institutional characteristics and the number of students accepted into an institution also factor into the college choice process. Taken together, these factors influence a student's

choice to enroll in college and in a specific type of institution. Although the higher education context in Perna's (2004) model refers to all institutions of higher education, this study is situated specifically within a community college context as I focused on students who participated in a DE program offered by a Virginia community college. Even though community colleges are institutions of higher education, their early beginnings, mission, and practices set them apart from traditional four-year institutions (Meier, 2013). Therefore, in this section I provide a brief historical account of community colleges in general and Virginia's Community Colleges in particular, highlighting their institutional fit in the educational pipeline to help students with the transition from secondary to postsecondary education.

Community colleges: An American institution. Community colleges have a relatively young history compared to other institutions of higher education in the nation. The origin of many of today's community colleges can be traced back to the junior college movement in the early 20th century (Boggs, 2010). The first junior college was established in Joliet, Illinois in 1901 (Koos, 1925), making it only recently that some of the first community colleges in America celebrated their centennial. Several of the first junior colleges were initially created as extensions of secondary public schools, while others served as a lower division (i.e., the first two years) of a four-year institution (Boggs, 2010; Koos, 1925; Joyner, 1989). Junior colleges also provided local educational opportunities to those who may not have been able to otherwise pursue a higher education—still an esteemed characteristic of community colleges today (Cohen et al., 2013; Koos, 1925; Meier, 2013).

The shift from junior colleges to the more comprehensive community colleges we recognize today most notably followed the publication of *Higher Education for American Democracy*, a report of the President's Commission on Higher Education (the "Truman Commission"), in the mid-20th century (Hutcheson, 2007; Zook, 1947). Unabashedly, the report called for "equal opportunity for all persons, to the maximum of their individual abilities and without regard to economic status, race, creed, color, sex, national origin or ancestry [as] a major goal of American democracy" (Zook, 1947, p. 3). As one historian explained, the democratization of higher education in America was "well-articulated in the work of the 1947 President's Commission on Higher Education, which, with the GI Bill of 1944, marked the beginning of a substantial shift in the nation's expectations about who should attend college" (Hutcheson, 2007, p. 107).

One would be remiss not to recognize the work of the Truman Commission as an early promoter of community colleges (Boggs, 2010; Hutcheson, 2007). Although just common words at first, specific terminology cited throughout the report would later become associated with the mission of public community colleges: access, democratization, and open-door admissions (Joyner, 1989). In this way, the Truman Commission developed the rhetoric and support for greater educational access for the majority of Americans, significantly changing the nation's perspective on higher education (Hutcheson, 2007). Despite the youthfulness of community colleges compared to other institutions of higher education in America and across the globe, their value in the higher education system should not be underestimated:

> American community colleges are much like the nation that invented them. They offer an open door to opportunity to all who would come, are innovative and agile

> in meeting economic and workplace needs, and provide value and service to individuals and communities. Little wonder that they are increasingly emulated around the world and have become the largest and fastest-growing segment of U.S. higher education. (Boggs, 2010, p. 2)

The humble beginnings of America's community colleges—to provide access to students from a variety of economic and academic backgrounds at an affordable cost—continues to inspire their mission today, validating the leverage they have in expanding postsecondary educational opportunities and the need for further research on specific programs (i.e., dual enrollment) that also promote college access and the students who participate in these programs.

Access, affordability, inclusivity, and economic development: The community college mantra. Community colleges have been referred to as the "Ellis Island of American higher education" (National Commission for Community Colleges, 2008, p. 5). With admission practices that allow students to matriculate with few to no eligibility requirements and to do so at various times throughout the year, these institutions have broadened access to postsecondary education in America (Cohen et al., 2013). Community colleges also offer postsecondary education opportunities for one-third the cost of a four-year institution (Ma, Baum, Pender, & Welch, 2016). With low cost tuition, community colleges further promote open access by reducing the financial barriers that prohibit some students from pursuing a higher education.

Open access and low tuition have helped community colleges create an important niche in the higher education system, particularly in regard to the students they serve. Student populations that are, historically, underserved in higher education and also less

likely to cross the finish line, find community colleges to be a more obtainable and affordable option (Cohen et al., 2013; Malcom, 2013). Importantly, across all undergraduates in the United States, 45% are enrolled in community colleges (USDOE, NCES, 2014).

Referred to as "pioneers of inclusivity" (Kramer, 2016, para. 5), community colleges enroll nearly as many minority students (46%) as White students (49%). Yet, the diversity among community college students is not limited to only race and ethnicity. Community college students also span different generations. The average age of community college students is 28 years old (AACC, 2016), and students range in age from their early teens to beyond 80 years of age (National Commission on Community Colleges, 2008). Many community college students are employed (77%), parents (30%), veterans (4%), and the first in their families to attend college (36%; AACC, 2016; Gault, Reichlin, Reynolds, & Froehner, 2014; National Commission on Community Colleges, 2008). Even high school students are among those enrolled in community college, as seen in DE programs (Marken et al., 2013).

Community colleges have also been referred to as the "economic engines for the nation" (Boggs, 2010, p. 3). Their role in educating America's workforce is apparent in the types and number of credentials they award. In 2008, the National Commission on Community Colleges reported that community colleges awarded more than 800,000 associate degrees and certifications annually, which accounted for 80% of first responders, such as police officers, firefighters, and emergency medical technicians, and nearly half of nurses and other health-care workers.

These figures illustrate the diverse students that community colleges serve, the affordable education and training opportunities they provide, and their relevancy in building America's workforce (Cohen et al., 2013; National Commission on Community Colleges, 2008). These facts also underscore the challenges confronting community colleges to help students not only access higher education, but also to succeed in it. Many students arrive at community college with little to no previous exposure to the college environment. Some community college students do not have the skills to cope with the rigors of college-level work or the required information networks—the social ties that help students understand college life—to successfully navigate the higher education system (Karp & Hughes, 2008).

The community college context provides opportunities of access to higher education to student populations typically shut out of four-year degree programs. One such avenue of access is DE programs, which help students tackle the challenges mentioned above by providing students early college experiences that expose them to college-level coursework, help them develop the academic and social skills needed to be successful in college, and build their confidence in their academic abilities (Barnett & Stamm, 2010; Kanny, 2015; Karp, 2012; Karp & Jeong, 2008). Yet, even within DE programs, there are differences in participation rates across student demographics and in outcomes. This study intends to inform this broader issue.

School and community context: College and career readiness (Layer 2). Students' experiences throughout their K-12 education can shape their orientation toward college, and the school context contributes to this orientation (Corwin & Tierney, 2007; Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009). The school (i.e., K-12) and

community context includes the various organizational structures that influence college enrollment (Perna, 2006). These structures include the availability of resources (e.g., access to information about college and career opportunities), types of resources (e.g., college and career counseling, college preparatory programs), and structural supports and barriers (e.g., academic curriculum, advising) that facilitate or impede a student's choice to attend college (Perna, 2006). Schools allocate financial and human resources to programs, services, and activities that help prepare students for college (Corwin & Tierney, 2007).

Researchers have explored how a school's culture promotes college enrollment and prepares students for college (Corwin & Tierney, 2007; Tierney et al., 2003). High schools with a strong college culture "cultivate aspirations and behaviors conducive to preparing for, applying to and enrolling in college" (Corwin & Tierney, 2007, p. 3). These schools are likely to offer students experiences that prepare them for college such as accelerated learning or early college programs (e.g., Advanced Placement, dual enrollment); academic, college, and career counseling; and workshops to prepare for college exams, apply to college, and apply for financial aid (Corwin & Tierney, 2007; Tierney et al., 2003). These college preparatory activities align with aspects of the high school experience that are associated with college preparation and enrollment: a rigorous high school curriculum, college and career preparatory activities (e.g., counseling, academic and college planning), and family and community engagement (Adelman, 2006; Corwin & Tierney, 2007; Tierney et al., 2003).

Unfortunately, constrained school resources and limited access to information about postsecondary education hinder schools from being able to adequately prepare

students for college. Helping students become ready for college is further complicated by the "great divide" between secondary and postsecondary institutions (Chait & Venezia, 2009, p. 8). These educational sectors are largely disconnected and uncoordinated, which has presented challenges in aligning curriculum, educational standards, and expectations (Chait & Venezia, 2009; Kirst & Usdan, 2009). The gap between secondary and postsecondary education is reinforced by "decades of difference and separation on many levels, including issues surrounding…postsecondary incentives to connect with K-12, content and performance standards…curriculum and instruction, support services, finance and budgeting, professional development and training,…data collection, and incentive structures" (Chait & Venezia, 2009, p. 8). Throughout the last century, these educational systems have evolved against the backdrop of major economic shifts (e.g., mandatory public education, democratization of higher education, demands for a more educated workforce), further bifurcating organizational, governance, and finance structures across these systems (Kirst & Usdan, 2009). In order to improve the educational opportunities for students, the gap between secondary and postsecondary education will need to be narrowed.

The academic curriculum in high school is a leading factor in college preparation, enrollment, and completion (Adelman, 2006; Tierney et al., 2003). Programs such as Advanced Placement (AP), International Baccalaureate (IB), Tech Prep, and DE provide students the opportunity to take challenging coursework, enriching the high school curriculum, better preparing them for the rigors of college coursework, and aligning secondary and postsecondary curriculum standards and expectations (Bailey & Karp, 2003). These programs will be discussed in more detail later in this chapter.

Although academic proficiency is a leading indicator of college readiness, it is not the only one (Karp, 2012). Prior to enrolling in college, students can also benefit from honing their nonacademic skills (e.g., time management, goal setting strategies) and learning about the role and expectations of being a college student (Chait & Venezia, 2009; Kanny, 2015; Karp, 2012). Another important indicator of postsecondary readiness is college knowledge described as "knowledge about how to apply, enroll, and succeed in a college environment" (Chait & Venezia, 2009, p. 3). Students need help with the transition from being a high school student to a college student in both academic and nonacademic ways, and K-12 schools are positioned to help them do that. As will be discussed more fully in the next section, DE programs are a strategy coordinated with K-12 schools that help bridge the gap between high school and college for students, making the transition smoother as they experience college as high school students.

Habitus: Individual characteristics and dispositions toward college (Layer 1). The habitus layer in Perna's (2006) student college choice model is comprised of individual demographics (e.g., gender and race/ethnicity) and components of social and cultural capital (e.g., value of a college education, information about college, etc.). We know that college enrollment rates vary across these individual characteristics. For instance, across recent high school graduates, 73% of females and 64% of males enrolled in college (USDOE, NCES, 2015a). Among race/ethnicity, 68% of Whites, 70% of Blacks, 65% of Hispanics, and 91% of Asians enrolled in college (USDOE, NCES, 2015b). There are also variations in college enrollment across income levels. Fifty-eight percent of individuals with low income enrolled in college compared to their middle- and high-income counterparts, with enrollments of 64% and 84%, respectively (USDOE,

NCES, 2015c). Historically, the college enrollment rates for students from minority and low-income backgrounds have not been as high as their White, high-income counterparts. Some of the increase in college enrollment rates for these students can be attributed to open access and low-cost tuition offered by community colleges and a greater proportion of students enrolling in these institutions.

The habitus layer includes the individual demographics and dispositions that help shape a student's orientation toward or away from college (Grodsky & Riegle-Crumb, 2010; Perna, 2006). For example, the socioeconomic status of a student's family has been correlated with the student's access to information about college and their expectations to attend college (Hahn & Price, 2008). Perna and Thomas (2006) acknowledged that some "research focuses on families and high schools and the ways in which family background can determine students' preparation for college and range of choices available" (p. 15). Relatedly, then, information and expectations about college are also associated with the school environment (Corwin & Tierney, 2007). The interplay between families and schools becomes more apparent when families and the schools in which their students are enrolled share similar demographics and economic means (Bourdieu, 2011; Kinzie et al., 2004). The socioeconomic status of families links to the type of support students have regarding their college aspirations. The distribution of students in a school participating in the free and reduced-price lunch program, therefore, might be reflective of the overall socioeconomic status of students and their families, and can serve as a proxy for socioeconomic status.

The familial resources and support that help prepare students for and orient them toward college are often lacking for students from lower socioeconomic backgrounds.

DE programs are seen as a strategy that can help fill this gap for these students by offering early college experiences in high school, exposing students to the rigors and social interactions of college (Barnett & Stamm, 2010; Kanny, 2015; Karp, 2012). However, research continues to reveal a disparity between students who are adequately prepared for college and their choice to enroll in college. Hahn and Price (2008) explored the college enrollment rates of "college-qualified" students. Students were deemed qualified for college if they had graduated from high school, had a grade point average of at least 2.5, took at least some college preparatory courses (e.g., honors, Advanced Placement, International Baccalaureate), and completed Algebra I or higher. They found that only 75% of college-qualified, low-income students enrolled in college compared to 95% of college-qualified, high-income students. These findings indicated differences in demographics among students who enrolled in college and those who did not after controlling for measures that regarded students as being adequately prepared for college. Dual enrollment programs were not explicitly identified as a part of the college preparatory curriculum in Hahn and Price's (2008) research, illuminating the opportunity to explore these programs more specifically to determine whether there are differences in student characteristics among DE students who either enrolled or did not enroll in college.

Other researchers set out to explore other factors within habitus that might explain a student's choice to enroll in postsecondary education. Grodsky and Riegle-Crumb (2010) studied college-going habitus in high school students, further revealing the linkage between social origins (e.g., race/ethnicity, parental education), preparatory commitment (e.g., academic performance, course taking patterns), and expectations for attending

college. Students with college-going habitus always believed they would attend college. These students also tended to perform better in school and take more advanced math classes, and were more likely to take the PSAT or PACT. According to researchers, "social origins do exert a substantial degree of influence on the probability of adopting a college-going habitus" (Grodsky & Riegle-Crumb, 2010, p. 29), yet not necessarily in the way one might expect. Interestingly, both advantaged and disadvantaged students benefitted from a college-going habitus, suggesting a stronger correlation between college-going habitus and college aspirations than between social origins and college aspirations. A college-going habitus was strongly correlated to beliefs about attending college and applying to college, and more than social origins were correlated with college aspirations. Similarly, I argue that DE students have some degree of college-going habitus because of their participation in a DE program. But as we know, not all DE students enroll in college. Therefore, differences among DE students' social origins (i.e., demographics), preparatory commitment (i.e., academic metrics), and postsecondary education pursuits were explored.

As will be discussed more fully in the next section, the impact of DE programs on college enrollment and degree completion has been the focus of several research studies. Although much has been learned about the benefits of these programs and the outcomes for participants, few studies have explored the differential outcomes across student populations. In this study, I explored potential differences among DE students' demographics and their choice to enroll in college. I also used academic metrics as indicators of a student's preparation and readiness for college. Taken together, student

demographics, academic metrics, and college enrollment informs the narrative of DE students and their postsecondary educational pathways.

Dual Enrollment (DE) Programs: Preparing High School Students for College

Collaborative partnerships between secondary and postsecondary institutions bridge the divide between these two education sectors, which helps each sector better prepare students for success in college (Fisher & Abbott, 2010; Hughes, 2010). Dual enrollment programs are an important strategy for these collaborative partnerships. With community colleges situated between secondary and other postsecondary institutions, they are a "logical partner" and "integral collaborator" for helping students with the transition from high school to college (Bragg, 2011, p. 366). Across the nation, the majority (71%) of DE students participate in programs provided by two-year institutions (Marken et al., 2013). In Virginia, 96% of the state's DE students are served by Virginia's 23 community colleges (SCHEV, 2015c). These figures illustrate the significant role community colleges serve in delivering DE opportunities, and ultimately college enrollment.

The term dual enrollment is sometimes used interchangeably with concurrent enrollment and dual credit (DC). Although the nuance of these titles is subtle, the distinction is relevant because it often reflects variations in program design, most notably in terms of how college credit is awarded. Dual *enrollment*, or what is sometimes referred to as concurrent enrollment, allows high school students to enroll in college courses while still in high school, earn college credit for the courses they successfully complete, and sometimes even receive high school credit for these DE courses (Colorado Department of Higher Education, 2014; Hughes et al., 2005). Dual *credit* programs also

allow high school students to enroll in college courses and definitively signify the opportunity for students to earn both high school and college credit simultaneously for the same course (Taylor, 2013). Therefore, the difference between these programs becomes more evident when credits are awarded as either college credit only (i.e., dual *enrollment*) or in fulfillment of high school graduation requirements as well as college credit (i.e., dual *credit*; Colorado Department of Higher Education, 2014; Hughes et al., 2005).

Although there is a distinction between dual *enrollment* and dual *credit* in some contexts, in Virginia and for the purposes of this study, the general term of dual enrollment is used to describe an arrangement that "allows high school students to meet the requirements for high school graduation while simultaneously earning college credit" (VCCS, 2008, p. 1). Any necessary distinction in terms will be explained within the context of the literature that is presented within this review.

Distinguishing DE from other program models. Throughout the literature, DE programs fall under several broad categories:

- credit-based transition programs "that encourage and allow high school students to take college courses and to earn college credit while still in high school" (Bailey & Karp, 2003, p. vii);
- academic pathways, which refer to "boundary-spanning curricula, instructional and organizational strategies, and meaningful assessments that either link or extend from high school to college, including both two- and four-year institutions" (Bragg, Kim, & Barnett, 2006, p. 6);

- early college access programs, which refer to the array of program models "that give high school students a 'jump start' on college'" (Abell Foundation, 2007, p. 5);
- accelerated learning programs, which refer to providing "young people the option to do college-level work in high school" (Hoffman et al., 2008, p. 16); and
- secondary-postsecondary learning options, which are "schools and programs that link secondary education with two- and four-year institutions of higher education and allow high school students to participate in college-level courses for credit and not for credit" (Lerner & Brand, 2006, p. vii).

Indicative in the name of the categories above is the overarching objective of the programs that fall within a respective category. In addition to DE and DC programs, other programs commonly included in the above categories are Advanced Placement (AP), International Baccalaureate (IB), Tech Prep, and Early and Middle College High Schools (E-MCHSs). Although a common objective among these programs is to prepare high school students for the academic rigors of postsecondary education, these programs vary in their approach, the types of students they serve, whether college credit is awarded, and whether they offer additional support services (Abell Foundation, 2007; Allen, 2010; Bailey & Karp, 2003). A summary of these program variations is included in Table 1.

Through DE coursework, high school students participate in actual college courses taught with a course syllabus, which differentiates them from AP and IB courses (Allen, 2010). Even though DE courses are college courses, they may be taught in the

high school and by high school teachers. Although this is an attractive aspect of DE because it helps eliminate barriers for high school students who may not have adequate transportation to take courses offered on the college campus, it raises concerns about the quality of these courses (Jobs for the Future, 2006).

Table 1

Summary of Variations in Program Models Preparing High School Students for Postsecondary Education

Program model	Primary goals	Primary audience	College credit	Support services
DE/DC	Expose students to college-level work; enrich high school experience, earn college credit	All	Yes	No
AP	Expose students to college-level work, enrich high school experience, earn college credit	High achievers	Potentially	No
IB	Earn college credit, prepare for college	High achievers	Yes	No
Tech Prep	Earn college credit, guide transition to college	Middle achievers	Yes	Limited: career counseling, academic advising
ECHS	Earn college credit, prepare for college	High achievers	Yes	Extensive: counseling, tutoring, mentoring
MCHS	Prepare at-risk students socially, emotionally, and academically for college	Middle and low achievers	Potentially	Extensive: counseling, tutoring, mentoring

Note. Adapted from "A 'jump start' on college: How early college access programs can help high school students in Baltimore City," by Abell Foundation, 2007, p. 11.

Student eligibility and faculty qualification requirements are common quality assurance measures of DE courses and are helpful in maintaining the postsecondary institution's accreditation standards (Jobs for the Future, 2006; Taylor, Borden, & Park, 2015). Faculty who teach DE courses might be employed by the high school and/or higher education institution, but are most often required to be qualified to teach at the postsecondary level (i.e., hold a master's degree; Young, Slate, Moore, & Barnes, 2014), which serves to further substantiate the expected quality and rigor of these courses.

The Advanced Placement (AP) program is a global academic program offered in secondary schools (The College Board, 2016b). The AP program is sponsored by The College Board, a non-profit organization that has helped expand access to higher education through partnerships with educational institutions for more than a century (The College Board, 2016a). Primarily, AP courses are offered to enrich the high school curriculum for high-achieving students who have exhausted advanced course offerings in high school (Klopfenstein & Lively, 2012). These advanced-level courses differ from DE courses in at least two significant ways: 1) AP courses are advanced-level *high school* courses, not *college* courses as is the case with DE; and 2) students are not guaranteed to receive college credit for AP coursework. After successfully completing an AP course, students may then pay to sit for the AP exam. Postsecondary institutions establish their own threshold and criteria for awarding college credit for AP exam scores, which means there are inconsistencies across institutions with the awarding of college credit for particular AP exam scores (Klopfenstein & Lively, 2012). As the Abell Foundation (2007) explained in their review of early access college programs, "The issue of whether or how AP courses are accepted for credit is significant in determining the value of the

AP program as a tool for accelerating students' college progress" (p. 7). With DE courses, however, students earn college credit upon successful completion of the course, suggesting that DE programs are valuable in accelerating students' progress in college. Yet, not all DE students choose to enroll in college after high school graduation, and this study explored if there are patterns among students who opt not to attend college after high school even when they have already successfully earned college credits.

The International Baccalaureate (IB) program offers an international education to high school students through its Diploma Programme. The IB program is implemented by a non-profit educational foundation and made available only in schools that have been authorized to deliver the IB program (IB, 2015a). A primary objective of the IB program is to "develop the intellectual, personal, emotional and social skills needed to live, learn and work in a rapidly globalizing world" (IB, 2015a, para. 1) and specifically to "students who have excellent breadth and depth of knowledge – students who flourish physically, intellectually, emotionally and ethically" (IB, 2015b, para. 6). Similar to AP, students who complete IB coursework may receive college credit after completing the program, which is at the discretion of the postsecondary institution (Hughes, 2010).

Through the Tech Prep program, each state receives federal funds, authorized by the Carl D. Perkins Vocational and Technical Education Act of 1998 (USDOE, 2014). Tech Prep consists of a planned sequence of study in technical, career-oriented education for two years of secondary education and at least two years of postsecondary education. A primary objective of the Tech Prep program is to assist students with the transition from school into the workforce by offering "two years of postsecondary occupational education or an apprenticeship program of at least two years following secondary

instruction, and culminates in an associate degree or certificate" (USDOE, 2014, para. 4). Likewise, early and middle college high schools (E-MCHSs) are similar in design, but serve different purposes. Both programs are delivered in the form of a small high school located on a college campus, provide a high school and college curriculum, and focus on student populations that are underachieving or underserved in higher education (Abell Foundation, 2007; Barnett et al., 2015). Further, both programs provide comprehensive academic and student support services to help students develop both academic and non-academic skills (Abell Foundation, 2007). Early and middle college high schools differ, however, in their intended outcomes for students. Students in ECHSs can earn a high school diploma and an associate degree simultaneously or often within four or five years, but students in MCHSs may or may not receive college credit for coursework (Abell Foundation, 2007). Whereas ECHSs have a specific focus on college enrollment and even college completion, MCHSs help bolster high school graduation rates of underachieving students who may not be college-bound (Abell Foundation, 2007).

The breadth of the impact of these programs is expected to vary as the participation rates for each program varies. In 2010-11, high schools reported approximately 2 million enrollments in DE and 3.5 million enrollments in AP or IB courses (Thomas, Marken, Gray, Lewis, & Ralph, 2013). The participation rates for the other program models are not readily available, making it difficult to consider the impact of the full range of ways high school students engage in college level work. However, as these programs serve different student populations and for different purposes, comparisons across program models are not necessarily helpful. When comparing DE and AP opportunities, for example, Klopfenstein and Lively (2012) would encourage that

these programs be "viewed as complements rather than as competitors" because they "serve different populations with different goals and that each is important in its own right" (pp. 59-60). I would extend this comment to apply to IB, Tech Prep, and E-MCHSs, as well, because these program models provide different kinds of postsecondary preparatory opportunities for high school students at varying academic levels and with different intended outcomes. Therefore, when measuring the impact of these programs, it is important to understand the purpose and intended outcomes of the program before making an assessment or drawing conclusions about the program's effectiveness (Karp & Jeong, 2008). The link between program design and evaluation is important for assessing DE programs, as well, because they too can vary in a several ways that influences program participation and outcomes (Hughes et al., 2012).

Unlike AP, IB, or Tech Prep, which are regulated by a central governing body, DE programs take on many different forms. Students' access to and experiences in DE programs are influenced by how the program is designed and implemented (Hughes et al., 2012). In a comprehensive review of the literature, Allen (2010) identified 10 areas of consideration for DE program design and implementation: 1) program approach, 2) organization and funding, 3) course delivery, 4) student selection and guidance, 5) faculty selection and supervision, 6) quality assurance, 7) relationships with high schools, 8) credit award and transfer, 9) marketing and public information, and 10) monitoring and evaluation. With the potential for so many variations among DE programs, it is important to consider the context in which a DE program is implemented and the intended outcomes for the program—two key components for this study of Virginia DE programs.

Intended outcomes for DE programs. Previous research has demonstrated positive outcomes for students who participate in DE programs and for the institutions that offer these programs. For many high school students, DE programs prepare them for the academic rigors of college coursework as well as the social aspects and expectations of life as a college student (Kanny, 2015; Karp, 2012). For secondary and postsecondary institutions, the decision to offer a DE program can lead to collaborative and strategic partnerships in which both educational sectors share responsibility for the college and career readiness of students (Barnett & Stamm, 2010; Bragg, 2011; Vargas, 2015).

As discussed earlier, DE programs can smooth the transition from high school to college for students. Throughout his review of the literature, Allen (2010) found that DE programs helped facilitate this transition by:

> Preparing students for college work and reducing the need for remedial coursework, enhancing the high school curriculum, making more effective use of the senior year in high school, developing the connection between high school and college curricula, raising the student's motivation and goal to attend college, acclimatizing students to the college environment. (p. 10)

Given these ways DE programs assist students with the transition into college, it stands to reason that students from a variety of academic and economic backgrounds could benefit from participating in these programs.

Drawing upon previous research, Karp (2012) identified the opportunity for DE programs to do more for preparing students for success in college besides preparing them academically. This research used "anticipatory socialization" and "role rehearsal" to describe the processes that helped students with their transition into college, connecting

these processes to the core design of DE programs (Karp, 2012, p. 21). Karp posited that DE could help smooth the transition from high school to college and support college success by providing students with the opportunity to learn "normative expectations—the habits, attitudes, and behaviors of successful college students" (p. 23). The opportunity to learn these normative college behaviors is appropriate for all students, which extends the utility of DE programs to students from a range of academic proficiency.

In brief, Karp (2012) observed that students who participated in DE learned about the role of a college student over the course of the semester. Further, students perceived their participation in DE as giving them the opportunity to realize, practice, and experience college expectations, which positively changed their knowledge and understanding of what to expect in college and their role as college students. These findings confirm the potential and value of DE programs in preparing all students for success in college because, through DE programs, students are given the opportunity to practice the role of college student and "practice gives participants the chance to understand truly what they need to do to be successful in their new role" (Karp, 2012, p. 27). Yet, with figures indicating that as many as four out of 10 DE students do not immediately enroll in college (Davenport, 2013), further research is needed to understand which DE students are not enrolling in college.

Relatedly, Kanny (2015) reported similar outcomes for DE students based on students' perceptions of their DE experience. Kanny observed three positive (benefits) and three negative (detriments) themes that emerged from interviews with study participants. Students perceived the benefits of their DE coursework to be exposure to college-level work and requirements; behaviors, attitudes, and expectations of college

students—labeled as “the hidden curriculum” (Kanny, 2015, p. 62) or what was previously labeled as “normative college behaviors” (Karp, 2012, p. 23); and independence and freedom. According to study participants, the drawbacks of participating in DE included issues with course grades and credits (e.g., impact of low or failing grades on high school transcripts and impact of college credits not being transferred or applied as expected); negative interactions with others students and faculty (e.g., negative reactions to having high school students in college classes); and limited support systems (e.g., students were uncomfortable and/or uncertain about accessing support services). Future research should focus on how secondary and postsecondary institutions can promote the positive experiences and mitigate the negative experiences for participants in DE programs. Knowing more about the connections with demographics and academic metrics of those who go on to college can provide insight into these experiences.

Similar conclusions were drawn by leading researchers in *Dual Enrollment Policies, Pathways, and Perspectives*, a special issue of *New Directions for Community Colleges*. The recurring theme that DE programs of today serve more than high-achieving or college-bound students readily emerged throughout the publication. This theme was articulated well by Karp (2015):

> Placing dual enrollment in the context of the college completion agenda raises its profile as an education reform. No longer is it solely a high school enrichment program; rather, it becomes a tool in the larger effort to ensure that all U.S. students have the opportunity to obtain a college credential. (p. 109)

Relatedly, Pretlow and Patteson (2015) also recognized that "as research is beginning to demonstrate, dual enrollment can be an effective transition tool for many students other than the traditional high achieving student" (p. 28). However, further research on the differential outcomes across student demographics is still warranted.

From previous studies, we know that students who participated only in DE programs—they did not also participate in any AP courses—are more likely to share precollege characteristics with students who do not participate in any accelerated courses than students who participated in either AP only or both AP and DE (An, 2015). These findings highlight that there are differences in demographics and academic metrics of DE students, which might be associated with their postsecondary educational pathways. Yet, after controlling for preexisting characteristics, Karp et al. (2007) found that male and low-income students were more likely to enroll in college than their more advantaged peers after participating in Florida's DE program. My study focused on similar demographic variables to determine if DE in Virginia results in a particular student group more likely to attend postsecondary education relative to their peers.

Swanson (2008) investigated the impact of DE on college persistence (i.e., second year college retention rate), number of credits earned, time-to-degree, and degree attainment. Swanson controlled for demographics (e.g., gender and race/ethnicity), high school variables (e.g., grade point average combined with class rank), and college variables (e.g., credits earned in various types of courses and in first year of college, time between high school and college enrollment, and type of institution). Results indicated that male DE students were more likely to attend open door colleges and less likely to enroll at a four-year institution immediately after high school graduation compared to

female DE students. Male and Hispanic DE students were less likely than female and White students to acquire 20 or more credits at the end of their first year of college. What remains unknown is if similar patterns occur in the DE programs in Virginia.

In an extensive study on Illinois' DE program, referred to as DC, Taylor (2013) found DE students were more likely to enroll in college and earn a credential than non-DE students. After controlling for race/ethnicity, DE students of color were still more likely to enroll in college and earn a credential than non-DE students of color, but less than the average of all DE students. Similar findings resulted when controlling for family income. Low-income students had higher rates of college enrollment and completion than their low-income, non-DE peers, but lower than the average of all DE students. Taylor concluded that "to the extent that underserved [DE] students do not benefit equally from [DE], and because [DE] is a pathway to access college, this also means that [DE] is not providing equal access to higher education" (p. 186). Again, at the beginning of this research, it was unknown if this outcome holds true in Virginia.

Controlling for preexisting student characteristics (e.g., race/ethnicity, socioeconomic status, etc.) and precollege variables (e.g., academic preparation and performance) continues to be a challenge for research in this area, and much of this challenge is the result of limited available data across educational sectors (Karp & Jeong, 2008). The need to control for precollege variables is what makes the examination of outcomes for DE programs in Virginia challenging and yet the dearth of research is what also makes it necessary.

Other researchers have reiterated several key benefits for participants of DE programs: college and career readiness (Carter, 2009; Kanny, 2015; Karp, 2012),

enrollment in college (Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Hughes et al., 2012; Karp et al., 2007; Speroni, 2012; Taylor 2013), college grade point average and retention (Allen & Dadgar, 2012; An, 2015; Karp et al. 2007), and college degree attainment (An, 2013; Pretlow, 2014; Speroni, 2012; Swanson, 2008; Taylor, 2013). However, the full reality of the outcomes of DE programs includes many students who do not immediately enroll in college after high school graduation (Davenport, 2013; Pretlow, 2014; Taylor, 2013). The potential and value of DE in the college completion agenda is dramatically undercut when students do not enroll in college because students "must enter college, as one cannot graduate from an institution one never started!" (Karp, 2015, p. 105). Yet, previous research has indicated a risk factor for even delayed enrollees, documenting that students who delay enrollment by more than one year after high school graduation are 64% less likely to complete a bachelor's degree (Bozick & DeLuca, 2005). Little is known about the timing of college enrollment for DE students beyond the fall semester following high school graduation, yielding another important area of focus. Knowing more about the variables that influence enrollment in postsecondary education remains a critical question in Virginia.

Understanding Student Habitus in Virginia DE Programs: A Proposed Model

Throughout this chapter, I have discussed factors within each layer of Perna's (2006) student college choice model as they pertain to college enrollment and DE programs. Using Perna's college choice model, I propose a model for exploring the relationship between student demographics and academic metrics (i.e., student habitus) and college enrollment patterns for Virginia DE students (see Figure 2). This study examines variables predominately within the individual habitus layer of Perna's model,

honing in on this layer as the framework for analysis and discussion. Although it is likely that other factors, such as school and community, are also influential in the postsecondary educational pathways of DE students, it is important to first understand the influence of these individual characteristics. Therefore, for the purposes of this study, research variables for student demographics and academic metrics are depicted in layer 1 as student habitus, and the other three layers help to understand the contextual factors that influence postsecondary educational pathways and build the context in which DE programs are structured and implemented in Virginia.

Building the Virginia context. Virginia offers a diverse public higher education system with 15 four-year institutions, one junior college, and a system of 23 community colleges. SCHEV is the coordinating body responsible for statewide academic policy, student enrollment data, state financial aid, and other statewide initiatives (SCHEV, 2015a). In 2015-16, more than 500,000 undergraduate students were enrolled in a Virginia public institution of higher education (SCHEV, 2015b). Half of these undergraduate students were enrolled in a Virginia community college (SCHEV, 2015b), a figure similar to national community college enrollments. The percentage of 25-34 year olds with a postsecondary degree in Virginia is higher than the national average, 45% compared to 39% (USDOE, 2012). However, Virginia lags the nation in regard to its college enrollment rates of graduating high school seniors. In Virginia, only 64% of graduating seniors enrolled in a postsecondary institution within 16 months of high school graduation (Virginia Department of Education [VDOE], 2015), whereas nationally 68% of graduating seniors enrolled within only four months of high school graduation (Bureau of Labor Statistics, 2015).

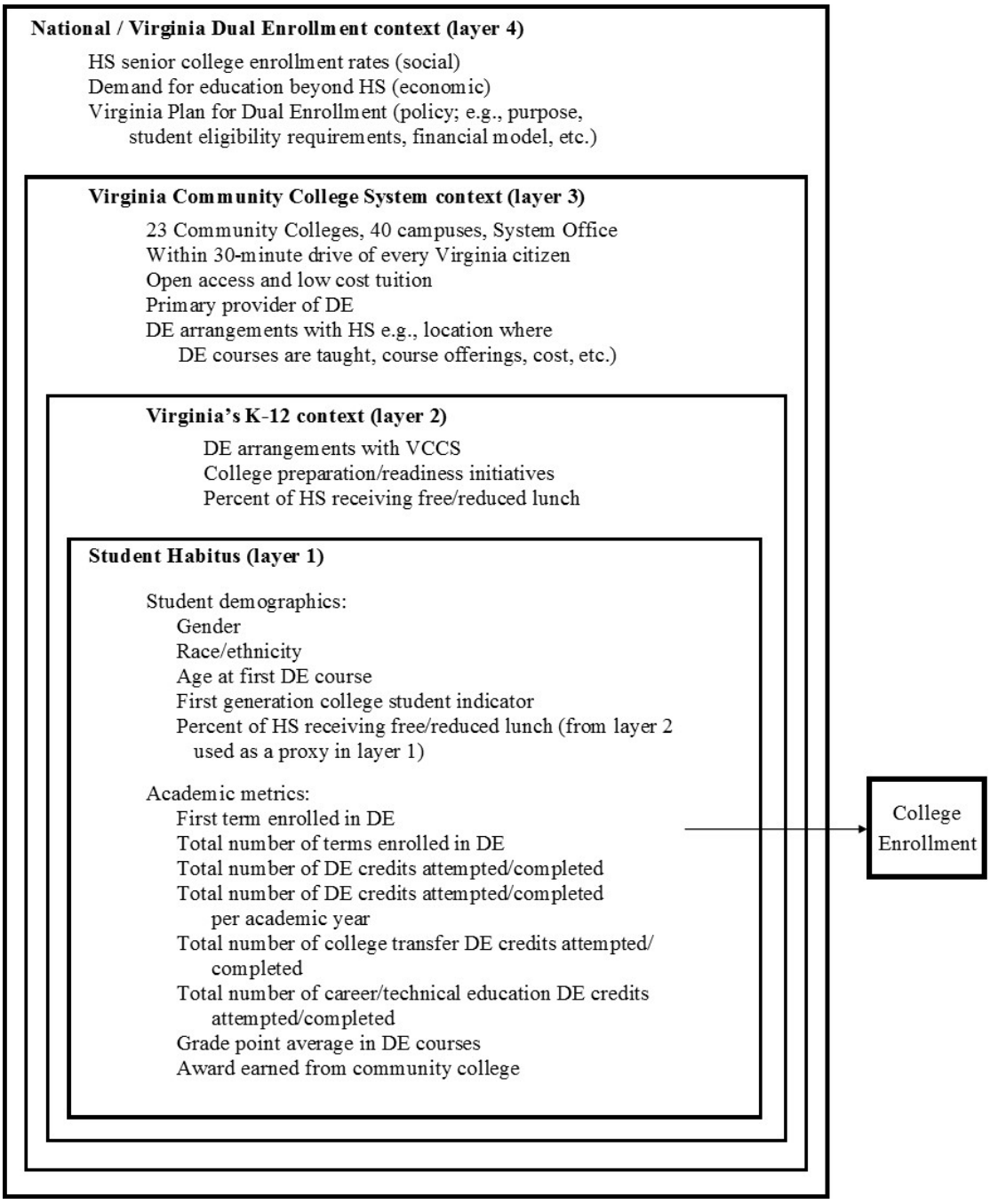

Figure 2. Exploring student habitus in Virginia DE programs. Adapted from "Studying college access and choice: A proposed conceptual model," by L. Perna, 2006, *Higher Education: Handbook of Theory and Research, XXI,* p. 117

For minority students in Virginia, the college enrollment rate drops to 57% for Blacks and Native Americans, and 55% for Hispanics (VDOE, 2015). Virginia high school students with limited English proficiency or students from families with low

income are even less likely to enroll in postsecondary education (55% and 50%, respectively; VDOE, 2015). A closer look at the college enrollment rates of Virginians was warranted in order to gain a better understanding of who is enrolling in college after high school graduation and when, especially for those students who have earned DE credits.

As discussed previously in this chapter, it is important to understand the factors influencing college enrollment in Virginia and across the nation. With the rise in jobs requiring at least some postsecondary education and training, improving college enrollment is essential. A recent report highlighted the growing demand for "middle-skill" jobs in Virginia that require postsecondary education beyond high school but not necessarily a four-year degree (National Skills Coalition, 2014). Drawing upon research from the Bureau of Labor Statistics, the VCCS (2015d) report indicated that "for every one job that requires an advanced degree, there are two jobs that require a bachelor's degree, and seven jobs that require postsecondary training that leads to an associate degree or industry-recognized credential" (p. 4). It is evident, then, that Virginia's Community Colleges play a significant role in building a stronger workforce and economy for the Commonwealth, and one that cannot be filled by other postsecondary institutions.

Virginia's community colleges: Within everyone's reach. The VCCS is comprised of 23 community colleges spanning across 40 campuses and a central administrative office that coordinates system-wide policies and initiatives in support of the colleges. The mission of the VCCS is to "give everyone the opportunity to learn and develop the right skills so lives and communities are strengthened" (VCCS, 2015a, para.

3). The breadth of this mission is evident in that half (50%) of undergraduate students attending a public institution in Virginia are enrolled at a community college (SCHEV, 2015b), and nearly every Virginian lives within a 30-minute drive of a community college campus (Kraus, 2014).

Yet large enrollments and easy access are not the mainstay of these community colleges. Rather the real impact of Virginia's Community Colleges is their ability to assist students on their pathway into a four-year institution and/or the workforce, and DE programs are a key strategy. Through the statewide DE program, Virginia institutions of higher education served more than 32,000 students in the 2015-2016 academic year (SCHEV, 2015c). Virginia's Community Colleges served 96% of DE students, with the remaining 4% served by the state's junior college and nine four-year institutions (SCHEV, 2015c).

Creating college and career pathways with Virginia DE. In collaboration with VDOE and VCCS, the *Virginia Plan for Dual Enrollment between Virginia Public Schools and Community Colleges* (Virginia Plan) was implemented in 1988. The Virginia Plan articulated the parameters for dual enrollment arrangements between public high schools and the local community college. However, rather than serving as an "official policy," the Virginia Plan maintained the authority given to each of the 23 community colleges "to structure its own program to meet the needs of its constituency" (Catron, 2001, p. 51). Although the Virginia Plan was later revised in 2005 and 2008, its purpose largely remained the same with each iteration (VCCS, 1988; 2005; 2008). The 2008 Virginia Plan was in effect until 2015 when more significant changes were made to

what is now referred to as *Governing Principles for Dual Enrollment between Virginia's Public Schools and the Virginia Community College System* (VCCS, 2015b).

Even though the most recent changes to the Virginia Plan restructured the section headings and content to provide a greater emphasis on quality standards and evaluation, the intent of dual enrollment in Virginia has remained largely unchanged for nearly three decades (VCCS, 2015b). The value of DE in Virginia is based on the ideal that "high school students who accrue college credit are more likely to continue with their education beyond high school than those who do not" (VCCS, 2008, p. 1). This argument is supported by Adelman (2006) who concluded that students with greater than six college credits were more likely to enroll in and complete college. Thus, a primary objective for DE in Virginia is to foster college enrollment. However, 36% of Virginia's DE students taking courses at community colleges do not immediately enroll in college the semester following high school graduation (Davenport, 2013). Similar studies reported that as many as 42% of Virginia's DE students did not immediately enroll in college after high school graduation (Pretlow, 2014). Within one year of high school graduation, the percentage of these non-college enrollees dropped to 31%, indicating that an additional 11% of DE students enrolled in college in the spring semester following their high school graduation (Pretlow, 2014). What remained unknown prior to my research, however, was which DE students immediately enrolled in college, delayed enrollment, or never enrolled in college. In order to gain this understanding, an examination of student data (i.e., student demographics and academic metrics) of Virginia DE students is needed, which was the impetus for this study.

Virginia's student habitus. A handful of dissertations and published studies have explored various components of Virginia's DE programs. However, together, these studies have offered little insight into the prototypical profile of DE students, a major component of the current study. In Davenport's (2013) dissertation, she explored the relationship between local wealth, a composite index of local ability-to-pay, and participation in DE. She also examined whether local wealth was a predictor of the type of institution, community college or four-year institution, where a DE student enrolled. Descriptive statistics revealed DE students were mostly White and female, and indicated a high percentage of DE students who did not enroll in college in the fall semester following high school graduation. In fact, as many as one in three DE students did not immediately enroll in college (Davenport, 2013).

Similarly, Pretlow's (2014) examination of college completion rates of Virginia DE students also portrayed DE students as mostly White and female. Using logistic regression, Pretlow investigated the effect of DE students' pathways into either community college or a four-year institution on degree attainment. His work revealed minimal differences between the two student groups in terms of demographics and the number of DE credits earned. However, Pretlow's research identified three predictor variables for the likelihood of a student earning a four-year degree: female, non-minority, and those who transferred directly into a four-year institution. Pretlow's research contributed to a prototypical profile of DE students who earned a college degree. Yet, we still do not have a profile of DE students, including those who did not enroll in college, and whether there are distinctions between those who enroll and those who do not enroll.

Westcott (2009) also studied the impact of DE on degree attainment, as well as time-to-degree, for DE students and non-DE students who enrolled directly into a community college after high school graduation. Based on the sample drawn, Westcott found differences between DE and non-DE students in terms of race/ethnicity with a higher percentage of White students participating in DE, and in terms of degree attainment and time-to-degree with DE students completing at higher rates and in a shorter amount of time, although differences were rather small. Across gender and classification of CTE or transfer, the sample was fairly evenly distributed between DE and non-DE students. However, differences among DE students and their college enrollment patterns remain unexplored.

In her dissertation, Carter (2009) focused on students who took DE courses classified as CTE offered by a community college in rural Virginia. Carter explored student perceptions of their DE participation, college enrollment, and workforce skill readiness, finding that students perceived their DE experience positively. The student profile of these CTE students included a fairly even distribution of male and female students; those with a high school grade point average between 3.00 and 3.49; a majority who did not receive free and reduced-price lunch; and a majority, although the difference was minimal, who were not first generation college students. Carter's research provided a narrow glimpse of the demographics of CTE DE students, offering the opportunity for further analysis of all DE students across Virginia.

Arnold (2015) conducted a comparative analysis to explore potential variations in student achievement (i.e., final grades) between English, biology, history, and mathematics courses that were taken as Virginia DE courses or in college by

academically-prepared students (i.e., identified as AIMS scholars). Student achievement outcomes were also compared across various methods of course delivery for DE courses (e.g., face-to-face at high school, face-to-face at college campus, and online). Arnold's work concluded that the majority of DE courses, 81%, were taken at the high school, 13% were taken online, and only 6% were taken at the community college. Overall, the results indicated that DE students earned higher grades in DE courses taught at the high school than DE courses taught at the college or online, and they earned higher grades than non-DE counterparts who were thought to be academically-comparable (i.e., AIMS scholars). However, Arnold did not report any student demographics for her study's sample.

Taken together, these studies on Virginia's DE students indicate an opportunity for further research to create a prototypical profile of DE students and to explore the differential outcomes of their participation in DE. For this study, the outcome of interest is college enrollment and the timing of college enrollment (i.e., immediate or delayed). Dual enrollment programs are valuable tools for preparing high school students for college and helping them earn a postsecondary credential. Yet this value is largely undermined when students do not even enroll in college.

Making the case for Virginia DE. The Commonwealth of Virginia is a prime candidate for the study of DE programs for at least three reasons. One reason is the policy governing DE arrangements is a statewide policy between public high schools and community colleges. The *Virginia Plan for Dual Enrollment* (VPDE or the Virginia Plan as used in this study) covers 96% of high school students participating in a Virginia DE and establishes Virginia's Community Colleges as the state's primary provider of DE

programs (SCHEV, 2015c). The Commonwealth's system of community colleges is another reason to study Virginia's DE programs. The systematic effort to offer DE opportunities to Virginia students stretches across the Commonwealth's diverse regions, providing a rich data source with a united purpose, shared terminology, and common data elements and measurements. The diversity of the Commonwealth—in terms of demographics, economic development, and secondary and postsecondary education opportunities—is the third reason to use Virginia as a unit of analysis for this study. This diversity across the Commonwealth of Virginia is reflective of the diversity across the United States.

Summary

College degree holders earn more money over their lifetime and have more career opportunities than those with only a high school education. Yet, even with the documented benefits of a college education and the rise in jobs that require at least some college, many high school graduates do not enroll in college. Dual enrollment has demonstrated its value in preparing high school students for college, promoting enrollment in college, and helping students with the transition from high school into college. These programs help bridge the gap between secondary and postsecondary education sectors, and the unique position of community colleges situates them as a leader in providing DE opportunities. It stands to reason, then, that DE programs offered by community colleges are primed for addressing the need for a more skilled and educated workforce.

The literature presented in this chapter reveals the importance of using disaggregated data in order to help policymakers, administrators, and educators

understand who is participating in DE programs—in terms of student demographics and academic metrics—and the outcomes for these participants. Having this level of understanding would help institutions design and deliver programs that maximize program outcomes for a broad range of students, which could then help close the educational achievement gap and build a stronger workforce. My study examined student demographics and academic metrics of DE students to investigate the potential relationship among student habitus and college enrollment patterns, providing a prototypical profile of DE students who immediately enrolled in college, delayed enrollment, or did not enroll.

CHAPTER 3: METHODS

The purpose of this study was to understand which student demographics and academic metrics influenced postsecondary educational pathways for high school graduates who participated in dual enrollment (DE) in Virginia's Community Colleges. Further, this study investigated the predictability of student demographics and academic metrics on student non-enrollment in postsecondary education.

Understanding which students are participating in and how they are benefitting (e.g., grade point average in DE courses, number of DE credits completed, enrollment in postsecondary education) from Virginia's Community Colleges' DE programs required examining the data at the student level. As outlined in Chapter 2, disaggregating the data at this level will reveal possible patterns among student demographics and academic metrics. Specifically, this study investigated whether differences exist among DE students who enrolled, delayed enrollment, or did not enroll in college based on student demographics such as gender, race/ethnicity, first generation college student indicator (a measure of parental education), and percentage of students in a school participating in the free and reduced-price lunch program; and academic metrics in DE courses such as grade point average in DE courses, number of credits attempted and completed, and types of credits earned, just to name a few. A comprehensive list of variables is found in Table 2 in the section on research variables, and outlines the student demographics and academic metrics for the study.

This chapter reiterates the research questions that guided this study and describes the methods that were used in the research design, data collection, and data analysis. To understand patterns in college-going behaviors of DE students, this study examined student demographics, academic metrics, and college enrollment of the 2012 cohort of high school graduates who completed at least one DE course offered by a Virginia Community College while in high school.

Research Questions

Three related sets of research questions were explored in this study:

1. What are identified student demographics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?
    a. How are student demographics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?
    b. How are student demographics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?
    c. How are student demographics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?
2. What are identified academic metrics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?

a. How are academic metrics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?
b. How are academic metrics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?
c. How are academic metrics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?

3. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of non-enrollment?
    a. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of delayed enrollment?
    b. Do identified school-level characteristics predict the rate of non-enrollment?

Methodology

The following section outlines the research design for this study. This study employed quantitative methodology. This design choice was optimal because the focus was on numerical and categorical data that could be quantified and measured (Sprinthall, 2007). This section includes the study context, the population and sample to be studied, data sources, research variables, the process for data collection, and the ways in which the data were analyzed.

Research design. This study used a quantitative ex post facto, or after the fact, design to explore whether student demographics and/or academic metrics are associated with student enrollment, delayed enrollment, or non-enrollment in postsecondary education (Sprinthall, 2007). Ex post facto research was appropriate for this study because the design relied on the "observation of relationships between naturally occurring variations in the presumed independent and dependent variables" (Gall et al., 2007, p. 306). Further, the data for the phenomenon to be studied—the potential influence of student demographics and academic metrics on college enrollment—already existed, could be measured objectively, and could be analyzed to make "better-than-chance predictions" about which research variables are associated with college enrollment (Sprinthall, 2007, p. 220). Similarly, the studies reviewed in Chapter 2 also utilized quantitative research methods, further substantiating the appropriateness for quantitative research for this study because these researchers were also looking at the relationships among variables that could be measured and analyzed with statistical procedures (Creswell, 2009).

Using quantitative data, this study utilized descriptive and inferential statistics to examine differences in student demographics and academic metrics among high school students who participated in DE and subsequently enrolled, delayed enrollment, or did not enroll in postsecondary education (see Tables 2 and 3). Together, these statistical analyses revealed postsecondary enrollment patterns of DE students based on certain variables and/or a collection of variables.

Study context. Through dual enrollment (DE) programs, Virginia's Community Colleges expand access to and promote success in postsecondary education by providing

students the opportunity to earn college credits while in high school. In Virginia, DE courses allow high school students to fulfill their high school graduation requirements while simultaneously earning credits for college for the same course (VCCS, 2008). Although four-year institutions in Virginia also provide similar opportunities for high school students to enroll in college courses, the Virginia Community College System is the primary provider of DE courses (SCHEV, 2013). In fact, 96% of high school students participating in DE are enrolled at a Virginia Community College (SCHEV, 2015a). This number is much larger than the national figure (71%; Marken et al., 2013), which makes Virginia a good state to examine for patterns among students enrolled in DE courses.

In Virginia, DE arrangements between public high schools and the community college are governed by the *Virginia Plan for Dual Enrollment* (VCCS, 2008, 2015). The Virginia Plan provides a statewide framework for public schools to partner with the local community college to offer DE opportunities to high school students. This statewide DE program yields a rich source of student data for the majority of DE students across the Commonwealth of Virginia without limiting analysis to a specific institution or region. Further, the VCCS matches their student DE data with postsecondary enrollment data from the National Student Clearinghouse, a non-profit organization that maintains a national dataset on college enrollment and degree records (National Student Clearinghouse, 2016). This matching process allowed me to explore postsecondary enrollment patterns of students enrolling at in-state and out-of-state institutions, which has been a limitation of previous studies that only evaluated enrollment at in-state

institutions (Colorado Department of Higher Education, 2014; Hughes et al., 2012; Karp et al., 2007).

According to Perna (2006), the student college choice involves multiple contextual layers that directly and indirectly influence college enrollment. In Chapter 2, I described these contextual layers to establish the Virginia context and specifically, the context of DE programs offered by Virginia's Community Colleges. Also, in the previous chapter, I discussed how DE programs are not created equal. Few published studies have focused on DE in Virginia (cf. Catron, 2001; Pretlow, 2014; Pretlow & Wathington, 2013, 2014) when compared to other statewide DE programs such as Florida (Karp et al., 2007), New York (Allen & Dadgar, 2012; Karp et al., 2007), Texas (Struhl & Vargas, 2012), and Washington (Cowan & Goldhaber, 2015; Johnson & Brophy, 2006). An opportunity for further research on Virginia's DE programs exists and specifically, it is important to better understand who is participating in and benefitting from these programs.

Previous studies on Virginia DE programs identified several common characteristics for DE students. For example, DE students in the state are typically female, White, attend high school in towns and rural areas, earn an average of 12.8 credits, and enroll in postsecondary education within one year after graduating high school (Pretlow, 2014; Pretlow & Wathington, 2013, 2014). Yet, as many as 36% of Virginia DE students do not immediately enroll in postsecondary education (Davenport, 2013). With nearly 4 out of 10 students not using the college credits they earned while in high school, there is much for policymakers and educators to learn about Virginia DE students. Particularly, it is important to first understand who these students are in terms

of their demographics and level of participation in dual enrollment (i.e., academic metrics) in order to then examine who subsequently enrolls, delays enrollment, and does not enroll in college.

Population and Sample

As indicated in the previous section, DE programs in Virginia are primarily delivered by Virginia's Community Colleges. The Virginia Plan, which governs these DE programs, was first implemented in 1988, and then later revised in 2005, 2008, and again in 2015. The revisions made in 2005 marked a significant shift in Virginia for DE as student eligibility was expanded to include all high school students, whereas previously, only juniors and seniors were eligible to participate in DE courses (VCCS, 2005). From 2004 to 2006, student participation in DE increased by 18.5% and the number of high schools offering DE increased by 15.3% (Pretlow & Wathington, 2014).

The revisions made in 2008 by the VCCS better articulated the roles and responsibilities of the local community college in administering DE programs, established expectations for quality assurance, and improved alignment with accreditation requirements from the Southern Association of Colleges and Schools (SACS; VCCS, 2008). Also, within the 2008 revision was a new stipulation for freshman and sophomore eligibility requirements. Now freshmen and sophomores would have to demonstrate they were ready for college coursework according to the college's policies and standards (VCCS, 2008), a requirement that was not a part of the 2005 Virginia Plan.

In 2015, the Virginia Plan was revised again, and renamed *Governing Principles for Dual Enrollment between Virginia's Public Schools and the Virginia Community College System*. The most significant changes in the 2015 revisions were to ensure the

quality and rigor of DE courses by establishing standards for evaluation, curriculum, faculty credentials, faculty responsibilities, and student support services (VCCS, 2015b). Other changes included revisions to the *VCCS Dual Enrollment Financial Model* and required DE students to be registered for courses by an established deadline (VCCS, 2015b).

The data sample for this study targeted students who began participating in DE after the 2008 revisions to the Virginia Plan, which went into effect in March 2008. Therefore, the student cohort graduating in spring 2012 who participated in at least one DE course as early as their freshman year (i.e., 2008-09) are assumed to have completed all DE coursework under the 2008 Virginia Plan. Since the students' age when they first enrolled in a DE course and the total number of DE credits attempted and earned were research variables in this study, student records for DE courses taken throughout the student's entire high school experience were analyzed. Therefore, this study focused on student data from fall 2008 to spring 2012, ensuring that the 2012 high school graduate cohort started and completed their high school DE courses under the auspice of the 2008 Virginia Plan.

During the timeframe of interest for this study (i.e., 2008-2012), Virginia's Community Colleges reported, on average 31,700 students per year participated in DE (VCCS, 2015c). It was my intent to analyze student records for all DE students that met the sample criteria for this study, which was two-fold: (1) all Virginia high school students who graduated in 2012, and (2) took at least one DE course from a Virginia Community College while in high school. The total number of student records eligible for this study was expected to be less than the total number of DE students enrolled in a

given year since the intent was to follow a single cohort of students who likely started high school in fall 2008 and graduated in spring 2012. As discussed in the next section, nearly approximately 20,000 students were eligible for inclusion in this study's sample.

Data sources. The primary data for this study was obtained from the Division of Academic Services and Research at the VCCS. The VCCS maintains student records in their Student Information System (SIS) for high school students enrolled in college courses provided by any of Virginia's 23 community colleges. Therefore, student demographics and academic metrics for DE students were obtained from data collected by the VCCS. For research purposes, the VCCS purchases postsecondary enrollment data of its students from the National Student Clearinghouse (NSCH). Therefore, these enrollment data were also obtained from the VCCS, although the data originated from the NSCH.

The proxy for family income (i.e., the percentage of the student's high school population that receives free and reduced-price lunch) was accessed from the Virginia Department of Education's (VDOE) public website in the *National School Lunch Program (NSLP) Free and Reduced Price Eligibility Report* (VDOE, 2012). Using the data from the VDOE report and the name of the high schools provided in the data set from the VCCS, the total free and reduced-price lunch percentage was matched to the respective high school for every student who graduated from a Virginia public or private high school.

For this study, the data that were analyzed were composed of student records that had been merged from these two data sources, which allowed me to explore possible patterns in college enrollment of DE students. Dual enrollment student records included

data from fall 2008 through spring 2012, and were merged with postsecondary enrollment records from summer 2012 through fall 2015, which were the most recent data available. In this study, the dependent variable was college enrollment as measured by enrollment in a public or private, two-year or four-year, in-state or out-of-state institution. Students do not always enroll immediately into college after graduating from high school and when they delay enrollment they are less likely to complete a postsecondary credential (Adelman, 2006; Bozick & DeLuca, 2005; Pretlow & Wathington, 2014). Therefore, for the purpose of this study, I reviewed the timeframe for college enrollment of DE students three years from high school graduation (i.e., from summer 2012 through fall 2015) and the institutional type (e.g., two-year or four-year institution) in which students enrolled.

Data collection. Data were requested from the Division of Academic Services and Research at the VCCS. A formal request to conduct research using VCCS data was submitted and approved by the VCCS prior to conducting any research. The VCCS has outlined procedures for conducting research to ensure the confidentiality and protection of the organization, its students, and its staff. The requested data set was delivered in a Microsoft Office Excel workbook. From this format, the data were imported into SPSS software, which was used for statistical analysis.

Research Variables

As discussed in Chapter 2, the variables explored in this study (see Table 2 for a comprehensive list of all research variables and their corresponding data source) were selected based on previous research that indicated a relationship between these variables and college enrollment. The independent variables included a collection of variables

categorized as student demographics and academic metrics. The dependent variable was college enrollment as measured by enrollment after high school graduation (between summer 2012 and fall 2015) or non-enrollment (not enrolled as of fall 2015). College enrollment was further analyzed as immediate enrollment (enrolled by fall 2012) or delayed enrollment (enrolled by fall 2013, by fall 2014, by fall 2015), and analyzed according to the institutional type (two-year institution or four-year institution). Table 2 lists the selected research variables for this study, a description of each variable, the data type for each variable, and the source from which the data originated.

Data Analysis

Descriptive statistics were conducted to provide information about the study sample through counts; percentages of the total; and measures of central tendency and variation, such as mean, median, and standard deviation (Warner, 2013). The results of these statistics summarized observations about each research variable and indicated whether the data were normally distributed. Normality is important for allowing the researcher to make inferences about the relationship between independent and dependent variables. Normality is also important for satisfying the assumptions of inferential statistics, which helps ensure the analyses are stable and reliable (Warner, 2013). Across various statistics, the sample data violated assumptions of normality due to the nature of the data (e.g., outliers that caused a non-normal distribution). However, the sensitivity of the data to these violations were minimized with the large sample size, and the analyses still offered some meaningful results as discussed in more detail in the next chapter.

Table 2

Summary of Research Variables, Description, Data Type, and Data Source

Research Variables	Description	Data Type	Data Source
Student Demographics			
Gender	Female, Male	Nominal	VCCS student records
Race/ethnicity	African American, American Indian/Alaskan, Asian, Hawaiian/Pacific Islander, Hispanic, White, Not Specified	Nominal	
Age in first DE course	Student's age in first term enrolled in DE course, calculated using the student's birthdate reported on community college application	Continuous	
First generation college student indicator	Indicator on student record that both parent's highest level of education was high school or lower. The first generation college student indicator is not applied to the student account when either or both parents have more than a high school diploma or either or both parent's education level is unknown.	Nominal	
Free and reduced-price lunch	Percentage of student's high school receiving free and reduced-price lunch from VDOE report and matched to high school included on VCCS student record.	Continuous	VCCS student records and VDOE Lunch Program Report

Research Variables	Description	Data Type	Data Source
Academic Metrics			
First term enrolled in DE	First term in which student enrolled in a DE course, categorized as freshman for first enrollment in fall 2008 or spring 2009; sophomore for summer 2009, fall 2009 or spring 2010; junior for summer 2010, fall 2010 or spring 2011; and senior for summer 2011, fall 2011 or spring 2012.	Nominal	VCCS student records
Total terms enrolled in DE	Total number of terms in which a student enrolled in DE	Continuous	
Total DE credits attempted	Total number of DE credits in which a student enrolled whether student successfully completed DE credits	Continuous	
Total DE credits completed	Total number of DE credits a student successfully completed	Continuous	
Total DE credits attempted per academic year	Total number of DE credits in which a student enrolled, whether student successfully completed DE credits, in each academic year in high school; freshman (2008-09), sophomore (2009-10), junior (2010-11), and senior (2011-12)	Continuous	
Total DE credits completed per academic year	Total number of DE credits a student successfully completed in each academic year in high school	Continuous	
Total college transfer DE credits attempted	Total number of DE credits classified as college transfer in which a student enrolled whether student successfully completed DE credits. College transfer courses include those pertinent to the first two years of a baccalaureate program and intended to facilitate transfer to a four-year institution for arts and sciences and preprofessional programs.	Continuous	

Research Variables	Description	Data Type	Data Source
Academic Metrics (cont.)			
Total college transfer DE credits completed	Total number of DE credits classified as college transfer a student successfully completed.	Continuous	
Total CTE DE credits attempted	Total number of DE credits classified as career/technical education in which a student enrolled whether student successfully completed DE credits. CTE courses are included in the curricula for applied associate degrees, CSC, certificates, and diplomas that lead to gainful employment (e.g., agricultural, business, engineering, health and medical, industrial, service, and other technical and occupational fields).	Continuous	
Total CTE DE credits completed	Total number of DE credits classified as CTE a student successfully completed.	Continuous	
GPA	Student's grade point average in DE courses, based on a 4.0 scale	Continuous	
Award	Award earned from community college; Career Studies Certificate, Certificate, Degree (e.g., AA, AA&S, AS), or both Certificate and Degree	Nominal	

Research Variables	Description	Data Type	Data Source
Postsecondary Enrollment			
Enrollment	Student enrolled in college, either in a two-year or four-year institution, following high school graduation in any subsequent semester	Nominal	NSCH postsecondary enrollment data
Non-enrollment	Student was not enrolled as of fall 2015	Nominal	
Immediate enrollment	Student was enrolled by fall 2012	Nominal	
Delayed enrollment	Student was enrolled by fall 2013, fall 2014, or fall 2015	Nominal	
Enrollment in two-year institution	Student was enrolled in a two-year institution following high school graduation in any subsequent semester	Nominal	
Enrollment in four-year institution	Student was enrolled in a four-year institution following high school graduation in any subsequent semester	Nominal	

Note. VCCS = Virginia Community College System; VDOE = Virginia Department of Education; DE = dual enrollment; CTE = career and technical education; CSC = Career Studies Certificate; NSCH = National Student Clearing House

Inferential statistics, such as chi-square for nominal or categorical data and analysis of variance (ANOVA) for continuous or ratio data, were used to explain variations in the sample. Table 3 outlines the statistical analyses that were used for each research variable and the corresponding research questions. The chi-square statistic was used to test for a statistically significant relationship between two variables using categorical data (Warner, 2013), such as the relationship between postsecondary enrollment and gender, race/ethnicity, and/or first generation college student indicator. Similarly, an ANOVA was used to test for statistically significant differences between group means for two or more groups using quantitative data (Warner, 2013), such as the total number of DE credits attempted and completed.

Table 3

Summary of Research Variables, Data Analysis, and Research Question

Research Variables	Data Analysis	Research Question
Student demographics: Gender, race/ethnicity, age at first DE course, first generation status indicator, percentage of high school on free and reduced-price lunch	Descriptive	RQ1
	Inferential statistics (e.g., chi–square and ANOVA)	RQ1a-c
Academic metrics: First term enrolled; total # of DE credits attempted and completed; credits per academic year; credits by course type; GPA; award	Descriptive	RQ2
	Inferential statistics (e.g., chi-square and ANOVA)	RQ2a-c
Student demographics and academic metrics (IV) and student non-enrollment (DV)	Binomial logistic regression (stepwise method)	RQ3, RQ3a
School-level characteristics: percentage of high school on free and reduced-price lunch, high school type, locale of high school, size of high school	Multi-level analysis	RQ3b

The procedure for a chi-square test includes determining differences between the expected and observed frequencies of the research variable and then, testing the differences for statistical significance (Sprinthall, 2007). Statistical significance indicates that the differences have occurred on the basis of a relationship between the research variables, rather than by chance or a random occurrence. The results of a chi-square indicate whether a DE student's enrollment in postsecondary education is correlated with the student's gender, race/ethnicity, or first generation college student indicator; the percentage of the student's high school receiving free and reduced-price lunch; first term enrolled; and/or the type of award, if any, the student earned from the community college before graduating from high school.

For research variables that are continuous, an ANOVA was used to measure differences in means between and among two or more groups, and to test for statistical significance of those differences (Sprinthall, 2007). Similar to the chi-square statistic, the results of ANOVA indicate whether a DE student's enrollment in postsecondary education is correlated with the student's age when enrolled in first DE course; the number of DE credits attempted and completed; the number of DE credits in college transfer courses and career and technical education (CTE) courses; and/or the student's grade point average in DE courses.

Binomial logistic regression analysis was also used to explore whether student demographics and/or academic metrics predict student non-enrollment in postsecondary education following high school graduation. Binomial logistic regression analysis, or simply logistic regression, allowed me to test for a predictive relationship of multiple predictor variables on postsecondary enrollment, categorized as either enrolled or not

enrolled (Warner, 2013). Thus, the results of logistic regression indicate whether a research variable or combination of variables can predict that a DE student will subsequently enroll or not enroll in college after high school graduation. A second layer of analysis was conducted to examine the timing of college enrollment. For students who enrolled in college, further analysis assessed the predictability of student habitus on a student's choice to immediately enroll in college (i.e., by the fall semester following high school graduation) or to delay enrollment (i.e., subsequent semester after the fall semester following high school graduation). Therefore, logistic regression was used to first investigate the predictability of student demographics and academic metrics on enrollment in college, and then, the predictability of immediate or delayed enrollment.

An important consideration with logistic regression is collinearity. Collinearity occurs when two or more predictor variables are correlated (Gall et al., 2007). When collinearity is detected, the predictor variables are seen as competing with one another, making it difficult for the researcher to interpret which variable(s) is the best predictor.

Further, this research was exploratory in nature and was not tied closely to a particular theory for the analysis. Therefore, the stepwise method, which introduces a variable at each step to determine whether it contributes to the predictive model, was used to run the logistic regression model. Using the stepwise method assessed the correlation of each new variable that was added to the model, keeping only those variables that were significant and removing those that were nonsignificant (Warner, 2013).

Finally, multi-level analysis was used to explore the influence of school context on the postsecondary educational pathways of DE students. In this multi-level analysis,

school-level characteristics as well as individual characteristics were analyzed, which allowed consideration of how the grouping of individuals within school contexts (level 2 variable) might contribute to college enrollment (Albright & Marinova, 2010).

Data errors and missing values. The data requested from the VCCS were provided in a Microsoft Excel workbook and included 19,382 student records of 2012 high school graduates who had taken at least one DE course between fall 2008 and spring 2012. The VCCS excluded records of students who graduated from high schools with fewer than 10 students who met the sampling criteria to eliminate the risk of unmasking a student's identity.

I reviewed the data set for any potential data that appeared to deviate from the norm, for potential data errors, and/or for missing values. Using conditional formatting and sorting the data table in multiple ways, I quickly identified only a small amount of missing values in 520 records (less than 3% of the sample) for one data element: total credits completed. For all 520 records, the student's GPA reported a value of zero. This scenario is likely the result of a student's grade for DE coursework not being recorded prior to the college's established deadline for submitting grades. Due to these missing values being the likely result of a data entry error, these records were removed from the sample. Therefore, the adjusted sample size used for data analysis was 18,862 individual student records.

This initial review of the data set provided by the VCCS resulted in a few deviations from the proposed plan for this study related to three research variables in particular: institution where DE courses were taken, program major, and program major award. The data request included the data element indicating where DE students took DE

courses (e.g., high school, college, or both). However, the VCCS was unable to provide these data because they were not collected during the timeframe of this study. Attempts were made to provide these data through other means, yet much of the data were best guess estimates and therefore, determined to be too unreliable to provide any value. Consequently, this research variable was not included in the analyses.

Similarly, program major and program major award were also included in the data request but these data elements were not collected during the timeframe of this study either. Although these data elements were provided by the VCCS, the data set reported "not declared" for program major and program major award for all student records, limiting the usefulness of these variables in the study. For this reason, these two research variables were also excluded from data analysis.

For the free and reduced-price lunch variable included in this study, the name of the DE student's high school was provided by the VCCS and then, matched to the percentage of the student's high school population receiving free and reduced-price lunch retrieved from VDOE's *National School Lunch Program (NSLP) Free and Reduced Price Eligibility Report* (VDOE, 2012). The NSLP operates primarily in public high schools, yet the data set also included students who graduated from 23 private high schools and students who were homeschooled for which free and reduced-price lunch data are not available. Therefore, for 21 private high schools, I used the school percentages of the public high school in closest physical proximity to the private high school where the student graduated. For the 13 public high schools that did not participate in the national lunch program and the two private high schools where the closest public high school did not participate in the national lunch program, I used the

school division percentages provided in the same VDOE report for these 15 high schools. For homeschooled students, in order to assign a free and reduced-price lunch percent to their student record, additional data, such as the student's address would have been necessary, but were not available in the data set. Therefore, this created missing values for the free and reduced-price lunch data element for 579 students who were homeschooled, or 3% of the sample. These missing values required some preliminary analysis to measure a potential difference in college enrollment between DE students who were homeschooled and DE students who graduated from a public or private high school. This step was necessary to assess whether removing these 579 students from the sample would introduce bias into subsequent data analysis. The results of this preliminary analysis are discussed below.

High school type and college enrollment. In lieu of a reliable or valid measure for the percentage of high school receiving free and reduced-price lunch, a value of "NA" was recorded for 579 students who were homeschooled. A chi-square test of independence was conducted between high school type (e.g., Homeschooled, High School) and college enrollment (e.g., Did Not Enroll, Enrolled) to determine whether DE students who were homeschooled were more or less likely to enroll in college than DE students who graduated from public or private high schools. There was a statistically significant association between high school type and college enrollment, $\chi^2(1, N = 18{,}862) = 14.496$, $p < .001$, although the association was small, Cramer's V = .028.

As shown in Table 4, students who were homeschooled enrolled in college at a rate higher than the overall sample, 90.5% and 85%, respectively. Students who graduated from a public or private high school enrolled in college at a rate similar to all

DE students included in the sample. These results indicate a difference in college enrollment patterns based on high school type.

Table 4

Enrollment in College of Virginia DE Students by High School Type

Variable	Total		Enrolled		Did Not Enroll	
	n	%	*n*	%	*n*	%
Total	18,862	100.00	16,019	84.93	2,843	15.07
High School Type***						
Homeschooled	579	3.10	524	90.5	55	9.5
High School	18,283	96.90	15,495	84.8	2,788	15.2

***$p < .001$

The free and reduced-price lunch variable was used as a proxy for family income, but posed an additional limitation to the current study because it was not available for students who were homeschooled. Consequently, any analyses using the free and reduced-price lunch variable did not include homeschooled students. From the preliminary analysis, students who were homeschooled were more likely to enroll in college than students who graduated from a public or private high school. Of the 579 students removed from this analysis because they did not have a value for free and reduced-price lunch, 524 enrolled in college or 90.5% of homeschooled students and 3.2% of all DE students who enrolled in college. By removing these students from the analysis, the results become slightly biased toward college non-enrollment compared to the entire sample of students. As a result, in any discussion about college enrollment patterns, I distinguish whether the results pertain to all Virginia DE students or only those students who graduated from a Virginia public or private high school.

In addition to this preliminary analysis, I performed supplemental analyses to explore potential differences between students who were homeschooled and students who

graduated from public or private schools across four other variables. The four variables that were explored were student's age in first DE course, total terms enrolled in DE, GPA, and total DE credits completed.

High school type and student's age in first DE course. A one-way ANOVA was performed to measure differences in the average age of students when they first enrolled in a DE course across students who were homeschooled, graduated from a private high school, and graduated from a public high school. Three assumptions of the one-way ANOVA were analyzed initially.

My initial review of boxplots indicated several outliers and extreme outliers for students who enrolled in a DE course at the age of 11, 12, and 20. While atypical, these outliers were confirmed as a valid measures of a student's age when first enrolled in a DE course, rather than errors in data entry. Although outliers can influence the results, the large sample size in this study helps minimize any potential influence.

The age of students when they first enrolled in DE was normally distributed for students who graduated from a private high school, but was not normally distributed for students who were homeschooled or students who graduated from a public school, as assessed by skewness and kurtosis values. Although a normally distributed sample is an assumption of the one-way ANOVA, with a large sample size and the robustness of the ANOVA to deviations in normality, the effect of this violation was presumed to be minimal.

The sample size in each student group was vastly different, as shown in Table 5. Levene's test indicated that the homogeneity of variance assumption was not tenable, $F = 3.587$, $p = .028$. Therefore, results for the one-way ANOVA were interpreted using

Welch's ANOVA, a conservative test for data that violates the assumption of homogeneity of variance. The results of the Games-Howell post hoc test were also used to determine between which high school type differences existed.

Table 5

Average Age of Student in First DE Course by High School Type

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	18,862	100.00	16.29	16.00	0.9	9
High School Type***						
Homeschooled	579	3.07	16.33	16.00	1.0	7
Private	546	2.90	16.43	16.00	1.0	6
Public	17,737	94.04	16.29	16.00	0.9	9

***$p < .001$

The average age of students when they first enrolled in DE was slightly higher for students who graduated from a private high school compared to students from pubic high school and homeschooled students, Welch's $F(2, 790.281) = 5.976$, $p < .001$. The Games-Howell post hoc analysis revealed the statistically significant difference existed between students who graduated from public and private high schools ($p = .003$). Although, the age at which students enrolled in their first DE course was statistically significant across high school type, the difference in age was too small to be of any practical importance.

High school type and terms enrolled in DE. A one-way ANOVA was performed to measure potential differences in the number of terms students were enrolled in DE courses across high school types. Similar to the previous analysis exploring age and high school type, the three assumptions of the one-way ANOVA were not fully met for the number of terms enrolled. Across the three high school types, only 193 students, or 1% of the sample, enrolled in seven or more terms (see Table 6). These students were

identified as outliers, but again, the large sample size minimizes the influence of these extreme values. The Levene's test indicated unequal variances, $F = 12.228$, $p < .001$, signifying that Welch's ANOVA would provide a better interpretation of the results and Games-Howell post hoc analysis would detect which, if any, groups differed.

Table 6

Average Terms Enrolled in DE by High School Type

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	18,862	100.00	2.37	2.00	1.3	9
High School Type***						
Homeschooled	579	3.07	2.59	2.00	1.5	9
Private	546	2.90	2.46	2.00	1.4	6
Public	17,737	94.04	2.36	2.00	1.3	8

***$p < .001$

The number of terms enrolled was slightly higher for students who were homeschooled than students who graduated from a private high school or public high school, a difference of 0.13 and 0.23 respectively. These differences were statistically significant, Welch's $F(2, 787.101) = 8.635$, $p < .001$, and the Games-Howell post hoc analysis revealed the statistically significant difference was between students who were homeschooled and students who graduated from a public high school ($p < .001$). However, again the differences were too small for any practical application, and suggest minimal disruption to the overall sample if homeschooled students were to remain in the sample for further analyses.

High school type and grade point average. Following the same procedure for age and terms enrolled, a one-way ANOVA was conducted to determine whether students' grade point average (GPA) in DE courses differed across high school type. The large sample size, robustness of the ANOVA statistic, and interpretation of Welch's ANOVA

and Games-Howell post hoc analysis helped minimize the impact of outliers, a non-normal distribution, and the unequal group sizes, $F = 30.090$, $p < .001$.

Table 7

Average GPA in DE Courses by High School Type

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	18,862	100.00	3.14	3.25	0.8	3.90
High School Type***						
Homeschooled	579	3.07	3.51	3.79	0.7	3.90
Private	546	2.90	3.28	3.43	0.7	3.00
Public	17,737	94.04	3.13	3.21	0.8	3.82

***$p < .001$

Students who were homeschooled earned a higher GPA than students who graduated from public or private high school, a difference of 0.38 and 0.23, respectively. The differences were statistically significant, Welch's $F(2, 821.825) = 102.072$, $p < .001$, and among all three high school types according to the Games-Howell post hoc analysis. These differences appear relatively small, yet further analysis would be helpful in gaining a better perspective on the potential relationship of GPA in college enrollment patterns of DE students, which is reported in Chapter 4.

High school type and total number of credits completed. Another analysis was conducted to explore differences across the three high school types in the total number of DE credits students completed. As with the previous analyses, there were violations of the assumptions for an ANOVA with outliers in the sample, a non-normal distribution, and unequal variances.

As shown in Table 8, the average of total DE credits completed varied across the three high school types with a greater variation between students who were homeschooled and students who graduated from either a public or private high school.

Homeschooled students completed an average of 5.4 and 5.5 more DE credits than students who graduated from a public or private high school private high school, respectively. Assuming a typical three-credit course, this difference would equate to nearly two additional DE courses completed by students who were homeschooled. Because homeschooled students are not enrolled in a formal institutional context, it is not surprising that they incorporated more DE courses in their high school curriculum.

Table 8

Average DE Credits Completed by High School Type

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	18,862	100.00	12.67	8.00	12.8	96
High School Type***						
Homeschooled	579	3.07	17.90	14.00	14.6	86
Private	546	2.90	12.44	8.00	11.7	64
Public	17,737	94.04	12.50	8.00	12.7	96

***$p < .001$

The total number of credits completed was statistically significantly different across high school type, Welch's $F(2, 793.198) = 38.633$, $p < .001$. According to the Games-Howell post hoc analysis, the differences were between students who were homeschooled and students who graduated from a private high school ($p < .001$) and students who were homeschooled and students who graduated from a public high school ($p < .001$). Students who graduated from private and public high schools did not differ statistically significantly in the number of total DE credits completed ($p = .992$) as might be expected with only a difference in credits completed equal to .06 credit. Based on these analyses, we now know that DE students who were homeschooled enrolled in college at higher rates than students who graduated from public or private high school,

and that these students completed more DE credits, alluding to a potential interaction between these two variables, which is explored in the next chapter.

The results of these four preliminary analyses comparing high school type across age in first DE course, terms enrolled in DE, GPA in DE courses, and total DE credits completed suggest some differences between homeschooled students and public and private high school graduates. With the exception of credits completed, the differences among high school types are small and not very meaningful. Based on these minimal differences, DE students who were homeschooled are included in the analysis of student demographics and academic metrics, except when analyzing the free and reduced-price lunch variable as discussed previously.

Race/ethnicity and college enrollment. There were 891 student records (approximately 5% of the sample) that did not specify race/ethnicity, a likely result of a student leaving this field blank on his/her community college application when enrolling in DE. A chi-square test of independence was conducted between race/ethnicity (e.g., Not Specified, Race Specified) and college enrollment (e.g., Did Not Enroll, Enrolled) to determine whether students who did not specify a race/ethnicity differed from those students who did specify a race/ethnicity in terms of their college enrollment patterns.

Table 9

Enrollment in College of Virginia DE Students by Race/Ethnicity Specified on Community College Application

Variable	Total		Enrolled		Did Not Enroll	
	n	%	*n*	%	*n*	%
Total	18,862	100.00	16,019	84.93	2,843	15.07
Race/Ethnicity						
Specified Race	18,011	95.49	15,282	84.84	2,729	15.15
Not Specified	851	4.51	737	86.60	114	13.39

An association between race/ethnicity and college enrollment was not statistically significant, $\chi^2(1, N = 18{,}862) = 1.957$, $p = .162$, indicating that any differences between college enrollment patterns of students with or without a race/ethnicity specified is most likely an occurrence of chance. Based on this result, further analyses were performed using all student records provided in the sample, including the 891 that did not indicate a specific race/ethnicity.

Ethical Considerations

The School of Education at the College of William & Mary requires all research studies to be reviewed by the EDIRC, the university's institutional review board. The VCCS also has specific procedures for conducting research using their data in order to preserve and protect the confidentiality of students and staff. A formal request for data is required from VCCS and a VCCS Research Review Team (RRT) reviews the request for data and has the authority to approve such requests. Upon approval from the RRT, I entered into a Data Release Research contract to ensure the safety and integrity of the VCCS and the ethical use of its data.

Assumptions, Delimitations, and Limitations

A few assumptions, delimitations, and limitations have been identified for this study exploring differences in postsecondary enrollment patterns of DE students based on student demographics and academic metrics. Dual enrollment programs intersect with multiple educational sectors, which presents challenges with accessing data across systems, similar to those associated with previous studies on DE programs. Assumptions and limitations are identified in the following section to address these data challenges.

Assumptions. It is assumed that the 2008 Virginia Plan was operationalized by Virginia high schools and community colleges after it was put into effect in March 2008. It is further assumed that students graduating from high school in 2012 likely entered high school as freshmen in fall 2008 and therefore, any DE courses taken as even as early as the freshman year (i.e., 2008-09) were operationalized under the 2008 Virginia Plan. Assumptions were made about the student's high school grade level when he/she first enrolled in DE while in high school (e.g., freshman year for fall 2008 or spring 2009; sophomore for summer 2009, fall 2009 or spring 2010; junior for summer 2010, fall 2010 or spring 2011; senior for summer 2011, fall 2011 or spring 2012).

Assumptions were made about the accuracy and completeness of the information included on the student's community college application (e.g., student's birthdate used to calculate age at first DE course, parental education used for first generation status indicator, name of student's high school used for free and reduced-price lunch variable, and anticipated date of high school graduation). These assumptions were necessary because the Virginia Community College System relies on these data elements as collected on the student's application for participation in DE courses offered by a Virginia community college.

Further, it is assumed that the diversity of the higher education system, public high schools, and student demographics in Virginia allow the data and results to be representative and generalizable to a larger, national population of DE students.

Delimitations. This study is delimited to DE students in Virginia. I conducted a quantitative analysis of student demographics and academic metrics of high school students who participated in at least one dual enrollment course offered by a Virginia

community college throughout their high school experience. This research was delimited to records of students who graduated high school in 2012, and completed at least one DE course during their high school experience. The DE population was delimited to the Commonwealth of Virginia and specifically to DE programs offered by Virginia's Community Colleges to establish contextual boundaries around the policies and programmatic structure of these DE programs.

Limitations. Some data limitations exist for this study. The relationship between family income and high school grade point average on college enrollment are well documented in the literature (Karp et al., 2007). Yet, these two important pieces of data were not available for this study. In the absence of family income, the percentage of the student's high school population that receives free and reduced-price lunch was used as a proxy. A limitation still exists with this proxy in that the data point reflects the overall high school population, which is then applied to the student, rather than an indicator of the individual student. Further, it is likely that some students changed schools during their high school experience, yet the VCCS does not necessarily track these changes. The percentage of free and reduced-price lunch were applied to the high school from which the student graduated under the assumption that this was the high school in which all DE coursework was taken.

Another potential limitation is the use the student's grade point average earned in DE courses as a proxy for academic performance in lieu of high school grade point average. These data limitations make it difficult to control for some important preexisting conditions of DE students, which may have an impact on postsecondary educational pathways. This means that some of the observed variation might be

explained by family income or high school grade point average, but was not accounted for in this study's model.

Also, using a post-facto research design allowed for predictive analysis to measure the relationship between variables, but does not indicate cause and effect (Sprinthall, 2007). This study could indicate whether student demographics and/or academic metrics are predictors of postsecondary enrollment, yet it could not infer the cause of enrollment.

Summary

The purpose of this study was to understand which student demographics and academic metrics influenced postsecondary educational pathways for high school graduates who participated in DE in Virginia's Community Colleges, and to explore the predictive value of these research variables on a student's choice not to enroll in postsecondary education. In this study, I conducted quantitative analyses on student records from the VCCS to describe, in terms of student demographics and academic metrics, the 2012 cohort of Virginia high school graduates who participated in at least one DE course during their high school experience. Postsecondary enrollment data from the NSCH were used to (a) determine postsecondary enrollment patterns of these DE students (e.g., college enrollment, timing of college enrollment, and institutional type in which student enrolled); (b) identify differences among students who enrolled or did not enroll in college after graduating from high school; and (c) predict student non-enrollment in college. Understanding the postsecondary educational patterns of DE students will help inform secondary and postsecondary administrators and policymakers

on who is benefitting from participation in DE and how they are benefitting from these early college access programs.

CHAPTER 4: RESULTS

Dual enrollment (DE) programs help students transition from high school into college by making the unfamiliar familiar—a valuable experience for students from a wide range of economic and academic backgrounds (Fisher & Abbott, 2010). However, researchers have found that some DE students do not continue their postsecondary education once they have graduated from high school (Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Davenport, 2013; Hughes et al., 2012; Karp et al., 2007; Pretlow & Wathington, 2014), suggesting a missed opportunity for these students, postsecondary institutions, and even employers needing educated workers. Yet, we know very little about these students in terms of their demographics and academic metrics of success.

In my study of student habitus of Virginia DE students and their enrollment in postsecondary education, I explored potential differences between DE students who enrolled and those who did not enroll in college after high school graduation. Further, I investigated whether certain variables and/or a collection of variables predicted that a DE student would not enroll in college. Descriptive, inferential, and predictive statistical models were used to explore three research questions, and the results of the research are presented in this chapter.

The chapter is organized by the three research questions with a section dedicated to each question. For the first two research questions, descriptive statistics were

conducted to provide demographic data for the entire sample of DE students, and then additional analyses were conducted to explore three dependent variables: (a) enrollment in college, (b) timing of college enrollment (e.g., immediate or delayed), and (c) the institutional type (e.g., two-year or four-year) in which they enrolled. Immediate enrollment includes students who enrolled in college by fall 2012 and delayed enrollment includes students who enrolled in college between spring 2013 and fall 2015. For the third research question, I performed a logistic regression to measure the predictability of student demographics and academic metrics on a DE student's enrollment in college and timing of college enrollment.

Research Question 1: Student Demographics

The first research question addressed descriptive differences among identified student demographics of Virginia DE students who graduated high school in 2012 and enrolled or did not in college after high school graduation. Identified student demographics included research variables for gender, race/ethnicity, student's age when he/she first enrolled in a DE course, first generation college student status, and percentage of high school receiving free and reduced-price lunch. The first research question and subset questions inquired:

1. What are identified student demographics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?
    a. How are student demographics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?

b. How are student demographics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?

c. How are student demographics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?

Results for this set of research questions are presented in the following section, focusing on five student demographic variables.

Student demographics of Virginia DE students. The sample of Virginia students who graduated in 2012 and took at least one DE course, less those who graduated from a high school with fewer than 10 DE students and/or who did not have a recorded number of completed DE credits, totaled 18,862. Demographic data for the sample are reported in Table 10. Of the students included in the sample, 53% were females, 73% were White, and 85% had parents who were college graduates (i.e., not first generation college students). The average age in which DE students first enrolled in a DE course was 16.29 years old (N = 18862, Mdn = 16.00, SD = .9). The youngest students first enrolled at the age of 11 (n = 2) and the oldest students enrolled at age 20 (n = 8). The percentage of the student's high school population receiving free and reduced-price lunch served as a proxy for family income. As discussed in Chapter 3, students who were homeschooled were excluded from the analysis for the free and reduced-price lunch variable. Values for free and reduced-price lunch ranged from 1% to 78% (n = 18283, M = 36.13%, SD = 15.2%) of the student population in the DE students' high schools receiving free and reduced-price lunch. For purposes of reporting counts and

Table 10

Student Demographics of Virginia DE Students by Enrollment in College

Variable	Enrolled		Did Not Enroll		Total	
	n	%	*n*	%	*N*	%
Total	16,019	84.93	2,843	15.07	18,862	100.00
Gender***						
Female	8,793	88.48	1,145	11.52	9,938	52.69
Male	7,226	80.97	1,698	19.03	8,924	47.31
Race/Ethnicity***						
African American	2,119	81.94	467	18.06	2,586	13.71
American Indian/Alaskan	58	75.32	19	24.68	77	0.41
Asian	522	86.00	85	14.00	607	3.22
Hawaiian/Pacific Islander	34	85.00	6	15.00	40	0.21
Hispanic	706	80.50	171	19.50	877	4.65
White	11,843	85.67	1,981	14.33	13,824	73.29
Not Specified	737	86.60	114	13.40	851	4.51
Age in first DE course						
11	1	50.00	1	50.00	2	0.01
12	5	100.00	0	0.00	5	0.03
13	75	86.21	12	13.79	87	0.46
14	628	81.14	146	18.86	774	4.10
15	1,876	84.24	351	15.76	2,227	11.81
16	6,270	86.16	1,007	13.84	7,277	38.58
17	6,385	85.67	1,068	14.33	7,453	39.51
18	737	75.82	235	24.18	972	5.15
19	36	63.16	21	36.84	57	0.30
20	6	75.00	2	25.00	8	0.04
First Generation***						
Yes	2,198	76.08	691	23.92	2,889	15.32
No	13,821	86.53	2,152	13.47	15,973	84.68
Free and reduced-price lunch***†						
< 25%	4,344	89.68	500	10.32	4,844	26.49
25-49%	7,669	84.36	1,422	15.64	9,091	49.72
50-74%	3,436	79.93	863	20.07	4,299	23.51
> 75%	46	93.88	3	6.12	49	0.27

†Counts exclude 579 records of students who were homeschooled (n = 18,283)
***p < .001

percentages of the total, the free and reduced-price lunch variable was broken into four groups: (a) <25%; (b) 25%-49%; (c) 50%-74%; and (d) >75%. Using this set of ranges

helps illustrate that approximately three-fourths of DE students graduated from a public or private high school where less than half of the population received free and reduced-price lunch. This data point suggests a potentially higher family income for the majority of DE students in the sample.

The following section includes the results and discussion of additional descriptive and inferential statistics of the sample's college enrollment patterns. The presentation of these results is in the order that the research variables appear in Table 10.

Student demographics of Virginia DE students by enrollment in college. A comparison of the demographics of DE students who enrolled in college and those who did not enroll was made to determine whether there were differences between the two groups. All demographic variables were found to be statistically significant at the $p <$ .001 level, with the exception of the student's age when first enrolled in a DE course. These results indicate differences between DE students who enrolled in college and those who did not across student demographic variables. Counts and percentages are reported in Table 10. A total of 85% of DE students enrolled in college either directly after high school or by fall 2015. College enrollment data are reported in the same format for each student demographic variable to allow for easy comparison of college enrollment patterns to the overall sample.

Female DE students were more likely to enroll in college than their male counterparts, $\chi^2(1, N = 18{,}862) = 206.938$, $p < .001$, and Cramer's V = .105. A review of the observed and expected frequencies of the chi-square indicated that more female DE students enrolled in college and fewer did not enroll than was expected. The inverse was true for male DE students with fewer male students enrolling in college and more not

enrolling than was expected. These results are apparent in Table 10 where the percent of females who enrolled in college was higher (88%) and the percent of males was lower (81%) than the percent of all DE students who enrolled in college (85%).

In terms of race/ethnicity, differences across race categories were also statistically significant, $\chi^2(6, N = 18{,}862) = 45.345$, $p < .001$, although rather small, Cramer's V = .049. Asian (86%), Hawaiian/Pacific Islander (85%), and White (86%) DE students enrolled in college approximately as was expected when compared to all students who enrolled in college (85%). However, African American (18%), American Indian/Alaskan (25%), and Hispanic (20%) DE students were represented higher as non-enrollers than the total sample of non-enrollers (15%). The statistically significant difference was attributed primarily to the lower than expected college enrollment rates of African American and Hispanic DE students, and the higher than expected college enrollment rates of White DE students as reflected in the adjusted residuals reported in Table 11. These results imply that DE students from specific minority backgrounds do not enroll in college at rates in line with the overall sample of DE students.

Table 11

Crosstabulation of College Enrollment and Race/Ethnicity

College Enrollment	Race/Ethnicity						
	African American	American Indian / Alaskan	Asian	Hawaiian / Pacific Islander	Hispanic	White	Not Specified
Enrolled	2119 (81.9%) (-4.6)	58 (75.3%) (-2.4)	522 (86.0%) (0.7)	34 (85.0%) (0.0)	706 (80.5%) (-3.8)	11740 (85.7%) (4.7)	737 (86.6%) (1.4)
Did Not Enroll	467 (18.1%) (4.6)	19 (24.7%) (2.4)	85 (14.0%) (-0.7)	6 (15.0%) (0.0)	171 (19.5%) (3.8)	1981 (14.3%) (-4.7)	114 (13.4%) (-1.4)

Note. Adjusted residuals appear in parentheses below observed frequencies

The average age when students first enrolled in DE was similar for DE students who enrolled and those who did not enroll in college. A one-way ANOVA revealed that any difference in the average age of college enrollers and non-enrollers was not statistically significant, Welch's $F(1, 3698.78) = 3.343$, $p = .068$. Violations of the assumptions of the ANOVA (e.g., outliers, normality, and unequal variance) required an interpretation of Welch's ANOVA.

Table 12

Average Age of Student in First DE Course by Enrollment in College

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	18,862	100.00	16.29	16.00	0.9	9
College Enrollment						
Enrolled	16,019	84.93	16.29	16.00	0.9	9
Did Not Enroll	2,843	15.07	16.33	16.00	1.0	9

First generation college students, those whose parents did not graduate from college, were less likely to enroll in college (76%) than students whose parents have a college degree (87%), illustrating a deviation from the college enrollment rate of all DE students (85%). The inverse, therefore—that first generation college students did not enroll in college (24%) at a rate greater than non-first generation college students (13%) and all DE students (15%)—is also true. The results of the chi-square were statistically significant, $\chi^2(1, N = 18{,}862) = 208.533$, $p < .001$, and Cramer's V = .105, a small association, indicating that the college enrollment rates of DE students is less for first generation college students.

Free and reduced-price lunch percentages ranged from 1.39% to 78.10% for both college enrollers and non-enrollers. The average percentage of high schools receiving

free and reduced-price lunch for DE students who enrolled in college was 4.08 percentage points less than the average for DE students who did not enroll in college (see Table 13). The difference was statistically significant and the Welch's ANOVA was interpreted due to unequal variances, $F(1, 3965.413) = 182.879$, $p < .001$. Dual enrollment students who graduated from high schools with a higher percentage of the population receiving free and reduced-price lunch were less likely to enroll in college than DE students from high schools with a lower percentage of free and reduced-price lunch participation and the overall sample of DE students.

Table 13

Average Percentage of High School Receiving Free and Reduced-Price Lunch by Enrollment in College

Variable	Missing	%	*n*	*M*	*Mdn*	*SD*
Total	579	3.07	18,283	36.13%	35.20%	15.2%
College Enrollment						
Enrolled	524	3.27	15,495	35.51%	34.56%	15.2%
Did Not Enroll	55	1.93	2,788	39.59%	40.45%	14.6%

Using the ranges established for reporting counts and percent of totals in Table 10, a chi-square was also performed to measure the relationship between free and reduced-price lunch percentages and college enrollment rates of DE students, $\chi^2(3, n = 18{,}283) = 172.684$, $p < .001$, and Cramer's V = .097. Specifically, the results of the chi-square provided a greater understanding for which range(s) of percentages most attributed to a statistically significant difference (see Table 14). In Table 10, deviations from the college enrollment rates of the overall DE sample are apparent for students who graduated from high schools with less than 25% and greater than 75% of students receiving free and reduced-price lunch. While 85% of DE students enrolled in college,

90% of students categorized in the lowest range of free and reduced-price lunch participation and 94% of students in the highest range enrolled in college. Comparing the results from Table 10 to Table 14, students in the lowest range (<25% free and reduced-price lunch participation) enrolled in college at a rate greater than expected and this contributed to the statistically significant difference. We also see that students in the third range (50-74% free and reduced-price lunch participation) also contributed to the significant difference, and for lower college enrollment rates than expected. Students in the highest range (>75% free and reduced-price lunch participation) had a limited contribution to significance, but did not meet the assumption of a cell size greater than five, limiting the reliability of this particular result. Using the free and reduced-price lunch percent as an indicator of the student's family income, these results revealed an association between college enrollment and the family income proxy of free and reduced-price lunch participation. The greater college enrollment rates for the higher range might suggest that schools with students from lower income backgrounds are engaged in efforts to promote college enrollment in an effort to reverse trends of traditionally lower college enrollment rates.

Table 14

Crosstabulation of College Enrollment and Ranges for Free and Reduced-Price Lunch Percentages

	Range for Free and Reduced-Price Lunch Percentages			
College Enrollment	<25%	25-49%	50-74%	>75%
Enrolled	4344 (89.7%) (11.1)	7669 (84.4%) (-1.5)	3436 (79.9%) (-10.1)	46 (93.9%) (1.8)
Did Not Enroll	500 (10.3%) (-11.1)	1422 (15.6%) (1.5)	863 (20.1%) (10.1)	3 (6.1%) (-1.8)

Note. Adjusted residuals appear in parentheses below observed frequencies

The majority of the 2012 cohort of Virginia DE graduates continued in postsecondary education after graduating from high school. As the data show, 85% of the sample enrolled in college within three years following high school graduation. The 2012 cohort's overall college enrollment rate is relative to the college enrollment rate of 2004 and 2006 cohorts, 87% and 86% respectively, as studied by Pretlow and Wathington (2014). The demographics of these college enrollees according to their timing of college enrollment were further studied and are presented in the following section.

Student demographics of Virginia DE students who enrolled in college by timing of college enrollment. After investigating college enrollment data to understand potential differences between students who enrolled and those who did not enroll in college, similar statistics were performed again on college enrollers based on the timing of their enrollment in college. Timing of college enrollment was categorized as immediate (enrolled by fall 2012) or delayed (enrolled between spring 2013 and fall 2015). Similar to the results of college enrollment, differences in the timing of college enrollment were detected across all student demographics except for student's age when first enrolled in a DE course (see Table 15). The majority of DE students who enrolled in college did so by the fall semester following high school graduation (89%). The remaining 11% enrolled in college in a subsequent semester between spring 2013 and fall 2015.

Out of all female DE students who enrolled in college, 90% immediately enrolled in college compared to 88% of male students and 89% of all DE students who immediately enrolled in college. These results also mean that female students were less

Table 15

Student Demographics of Virginia DE Students who Enrolled in College by Timing of College Enrollment

Variable	Immediate (Fa 2012)		Delayed (Sp 2013-Fa 2015)		Total	
	n	%	*n*	%	*n*	%
Total	14,204	88.67	1,815	11.33	16,019	84.93
Gender***						
Female	7,878	89.59	915	10.41	8,793	54.89
Male	6,326	87.54	900	12.46	7,226	45.11
Race/Ethnicity***						
African American	1,785	84.24	334	15.76	2,119	13.23
American Indian/Alaskan	55	94.83	3	5.17	58	0.36
Asian	476	91.19	46	8.81	522	3.26
Hawaiian/Pacific Islander	33	97.06	1	2.94	34	0.21
Hispanic	570	80.74	136	19.26	706	4.41
White	10,644	89.88	1,199	10.12	11,843	73.93
Not Specified	641	86.97	96	13.03	737	4.60
Age in first DE course						
11	1	100.00	0	0.00	1	0.01
12	4	80.00	1	20.00	5	0.03
13	62	82.67	13	17.33	75	0.47
14	534	85.03	94	14.97	628	3.92
15	1,659	88.43	217	11.57	1,876	11.71
16	5,606	89.41	664	10.59	6,270	39.14
17	5,701	89.29	684	10.71	6,385	39.86
18	607	82.36	130	17.64	737	4.60
19	26	72.22	10	27.78	36	0.22
20	4	66.67	2	33.33	6	0.04
First Generation***						
Yes	1,846	83.99	352	16.01	2,198	13.72
No	12,358	89.41	1,463	10.59	13,821	86.28
Free and reduced-price lunch***†						
< 25%	3,935	90.58	409	9.42	4,344	27.12
25-49%	6,837	89.15	832	10.85	7,669	47.87
50-74%	2,973	86.53	463	13.47	3,436	21.45
> 75%	40	86.96	6	13.04	46	0.29

†Counts exclude 579 records of students who were homeschooled (n = 15,495)
***p < .001

likely to delay enrollment in college than male students and all DE students. Although the differences in the timing of college enrollment across gender were found to be statistically significant, $\chi^2(1, n = 16{,}019) = 206.938$, $p < .001$, the association was small, Cramer's V = .105.

Across the seven race/ethnicity categories, four groups were more likely to immediately enroll in college than the overall sample of DE students: American Indian/Alaskan students (95%), Asian students (91%), Hawaiian/Pacific Islander students (97%), and White students (90%). This means that among the other three groups, students delayed enrollment at greater rates than all DE students who delayed enrollment: African American students (16%), Hispanic students (19%), and students who did not specify a race/ethnicity on their college application (13%). These results are statistically significant $\chi^2(6, n = 16{,}019) = 16.576$ $p < .001$, but again the association was rather small, Cramer's V = .084. The statistically significant difference was attributed primarily to more African American and Hispanic students delaying college enrollment and fewer White students delaying college enrollment than expected as reported in the adjusted residuals in Table 16. These data reveal the propensity for students from certain minority

Table 16

Crosstabulation of Timing of College Enrollment and Race/Ethnicity

Timing of Enrollment	Race/Ethnicity						
	African American	American Indian / Alaskan	Asian	Hawaiian / Pacific Islander	Hispanic	White	Not Specified
Immediate	1785 (84.2%) (-6.9)	55 (94.8%) (1.5)	476 (91.2%) (1.8)	33 (97.1%) (1.5)	570 (80.7%) (-6.8)	10644 (89.9%) (8.1)	641 (87.0%) (-1.5)
Delayed	334 (15.2%) (6.9)	3 (5.2%) (-1.5)	46 (8.8%) (-1.8)	1 (2.9%) (-1.5)	136 (19.3%) (6.8)	1199 (10.1%) (-8.1)	96 (13.0%) (1.5)

Note. Adjusted residuals appear in parentheses below observed frequencies

backgrounds to postpone enrolling in college for at least one semester after graduating from high school compared to the overall sample of DE students.

The average age of students when they first enrolled in a DE course was the same for students who immediately enrolled in college (n = 14204, M = 16.29, SD = .9) and students who delayed enrollment (n = 1815, M = 16.29, SD = 1.0). The Welch's ANOVA was interpreted due to violations of the assumptions for outliers, a normally distributed sample, and unequal group sizes. As could be expected with no difference between group means, the result was found not to be statistically significant, Welch's $F(1, 2195.159) = .085$, $p = .771$, indicating that a student's age when first enrolled in DE was not related to whether the student immediately or delayed enrollment in college.

In the previous analysis, DE first generation college students were less likely to enroll in college than DE non-first generation college students. Here the data indicate that of those first generation college students who did enroll in college, they were more likely to delay enrollment (16%) than their non-first generation counterparts (11%) or all DE students (11%). Thus, first generation college students were less likely to enroll immediately (84%) compared to non-first generation college students (89%) and the overall sample (89%). These differences were statistically significant, $\chi^2(1, n = 16{,}019) = 55.640$ $p < .001$, with a small association, Cramer's V = .059.

Free and reduced-price lunch percentages ranged from 1.39% to 78.10% for students who immediately enrolled in college and ranged from 5.38% to 78.10% for students who delayed enrollment. Dual enrollment students who immediately enrolled in college graduated from high schools with an average percentage of free and reduced-price lunch participation 2.12 percentage points less than the average for DE students

who delayed enrollment (see Table 17). Due to unequal variances, the Welch's ANOVA was interpreted and revealed a statistically significant difference, $F(1, 2146.255) = 29.160$, $p < .001$. Thus, DE students who graduated from high schools with a greater percentage of students receiving free and reduced-price lunch were more likely to delay enrollment in college than DE students from high schools with a lower percentage of free and reduced-price lunch participation. Assuming the free and reduced-price lunch percentage is a relevant indicator of family income and the association exists between this variable and the timing of college enrollment, then students from families with higher income are more likely to enroll in college the semester following high school graduation.

Table 17

Average Percentage of High School Receiving Free and Reduced-Price Lunch by Timing of College Enrollment

Variable	Missing	%	*n*	*M*	*Mdn*	*SD*
Total	524	3.27	15,495	35.51%	34.56%	15.2%
Timing of Enrollment						
Immediate	419	2.95	13,785	35.28%	34.30%	15.2%
Delayed	105	5.79	1,710	37.40%	36.26%	15.4%

A chi-square was also performed to explore these data in a different manner by using the ranges for free and reduced-price lunch percentages reported in Table 18. The results of this analysis for the timing of college enrollment differ from the previous analysis for college enrollment in that students who graduated from high schools with less than 50% receiving free and reduced-price lunch were more likely to enroll immediately in college than those who graduated from high schools where 50% and greater received free and reduced-price lunch. These differences were statistically

significant, $\chi^2(3, n = 15{,}495) = 32.903$, $p < .001$, and Cramer's V = .046 (see Table 18), and follow a pattern that students from families with higher income (as measured by lower high school participation rate in free and reduced-price lunch) are more likely to immediately enroll in college, rather than delay enrollment.

Table 18

Crosstabulation of Timing of College Enrollment and Ranges for Free and Reduced-Price Lunch Percentages

	Range for Free and Reduced-Price Lunch Percentages			
Timing of Enrollment	<25%	25-49%	50-74%	>75%
Immediate	3935 (90.6%) (4.0)	6837 (89.2%) (0.7)	2973 (86.5%) (-5.2)	40 (87.0%) (-0.4)
Delayed	409 (9.4%) (-4.0)	832 (10.8%) (-.07)	463 (13.5%) (5.2)	6 (13.0%) (4.0)

Note. Adjusted residuals appear in parentheses below observed frequencies

Of the DE students who enrolled in college from the 2012 cohort, 89% immediately enrolled after high school graduation (i.e., in summer or fall 2012) and 11% delayed enrollment to a subsequent semester (i.e., between spring 2013 and fall 2015). These results appear promising in terms of college completion for these DE students as previous research has demonstrated students are less likely to complete college when they delay enrollment in college (Adelman, 2006; Bozick & DeLuca, 2005). The potential and risks associated with immediate and delayed college enrollment are discussed further in Chapter 5. In the next section, I further review the postsecondary education patterns of these college enrollers based on the institutional type (e.g., two-year or four-year) in which they enrolled.

Student demographics of Virginia DE students who enrolled in college by institutional type. Analyses were also performed to explore differences in student demographics between students who enrolled in a two-year institution and those who enrolled in a four-year institution. These results are presented in Table 19 and show that 35% of DE students who enrolled in college enrolled in a two-year institution and 65% enrolled in a four-year institution.

Female DE students were more likely to enroll in a four-year institution (66%) than male students (63%) and slightly more than the overall sample (65%). The different enrollment rates were found to be statistically significant, $\chi^2(1, n = 16{,}019) = 15.413$, $p < .001$, and Cramer's V = .031, indicating that there is an association, although small, between gender and type of institution in which DE students enrolled.

Several differences were observed among the categories for race/ethnicity, $\chi^2(6, n = 16{,}019) = 85.566$, $p < .001$, and Cramer's V = .073, another small association. In comparison to the overall sample (35%), Hawaiian/Pacific Islander (44%) and Hispanic (45%) DE students who enrolled in college were more likely to enroll in a two-year institution than a four-year institution. However, the inverse was true for African American students (66%) and Asian students (79%) who were more likely to enroll in a four-year institution at higher rates than the overall sample (65%). More Asian students enrolled in a four-year institution than expected and more Hispanic students enrolled in a two-year institution than was expected, which contributed to the statistically significant difference reflected in the adjusted residuals in Table 20.

Table 19

Student Demographics of Virginia DE Students who Enrolled in College by Institutional Type

Variable	Enrolled in 2-year		Enrolled in 4-year		Total	
	n	%	*n*	%	*n*	%
Total	5,668	35.38	10,351	64.62	16,019	84.93
Gender***						
Female	2,993	34.04	5,800	65.96	8,793	54.89
Male	2,675	37.02	4,551	62.98	7,226	45.11
Race/Ethnicity***						
African American	729	34.40	1,390	65.60	2,119	13.23
American Indian/Alaskan	21	36.21	37	63.79	58	0.36
Asian	110	21.07	412	78.93	522	3.26
Hawaiian/Pacific Islander	15	44.12	19	55.88	34	0.21
Hispanic	320	45.33	386	54.67	706	4.41
White	4,242	35.82	7,601	64.18	11,843	73.93
Not Specified	231	31.34	506	68.66	737	4.60
Age in first DE course***						
11	1	100.00	0	0.00	1	0.01
12	1	20.00	4	80.00	5	0.03
13	30	40.00	45	60.00	75	0.47
14	221	35.19	407	64.81	628	3.92
15	653	34.81	1,223	65.19	1,876	11.71
16	2,114	33.72	4,156	66.28	6,270	39.14
17	2,249	35.22	4,136	64.78	6,385	39.86
18	371	50.34	366	49.66	737	4.60
19	24	66.67	12	33.33	36	0.22
20	4	66.67	2	33.33	6	0.04
First Generation***						
Yes	1,154	52.50	1,044	47.50	2,198	13.72
No	4,514	32.66	9,307	67.34	13,821	86.28
Free and reduced-price lunch***†						
< 25%	1,073	24.70	3,271	75.30	4,344	27.12
25-49%	2,822	36.80	4,847	63.20	7,669	47.87
50-74%	1,474	42.90	1,962	57.10	3,436	21.45
> 75%	11	23.91	35	76.09	46	0.29

†Counts exclude 579 records of students who were homeschooled (n = 15,495)
***$p < .001$

Table 20

Crosstabulation of Institutional Type and Race/Ethnicity

Institutional Type	Race/Ethnicity						
	African American	American Indian / Alaskan	Asian	Hawaiian / Pacific Islander	Hispanic	White	Not Specified
2-year	729 (34.4%) (-1.0)	21 (36.2%) (0.1)	110 (21.1%) (-7.0)	15 (44.1%) (1.1)	320 (45.3%) (5.7)	4242 (35.8%) (1.9)	231 (31.3%) (-2.3)
4-year	1390 (65.6%) (1.0)	37 (63.8%) (-0.1)	412 (78.9%) (7.0)	19 (55.9%) (-1.1)	386 (54.7%) (-5.7)	7601 (64.2%) (-1.9)	506 (68.7%) (2.3)

Note. Adjusted residuals appear in parentheses below observed frequencies

In this set of analyses, the student's age when first enrolled in a DE course was found to be statistically significant, Welch's $F(1, 11002.099) = 20.002$, $p < .001$. Although the difference between students who enrolled in a two-year institution and those who enrolled in a four-year institution was relatively small (0.07), there are some observable patterns with older DE students enrolling in two-year institutions at higher rates than all DE students enrolling in these institutions, 18-year olds (50%), 19-year olds (67%), and 20-year olds (67%). Students who first enrolled in DE at younger ages, specifically 12- and 13-year olds, enrolled in four-year institutions at a rate higher than the overall sample, 80% and 60%, respectively.

Table 21

Average Age of Student in First DE Course by Institutional Type

Variable	*n*	%	*M*	*Mdn*	*SD*	*R*
Total	16,019	100.00	16.29	16.00	0.9	9
Institutional Type						
2-year	10,351	64.62	16.33	16.00	1.0	9
4-year	5,668	35.38	16.26	16.00	0.9	8

A greater proportion of DE first generation college students enrolled in a two-year institution (52.5%) than a four-year institution (47.5%). The distribution of enrollment by institution type for first generation college students was different than the overall sample of DE students. However, this enrollment pattern was not the same for DE non-first generation students. Those students who had parents that attended college enrolled in four-year institutions (67%) at a higher rate than two-year institutions (33%) and higher than all DE students. These differences were statistically significant, $\chi^2(1, n = 16{,}019) = 326.553$, $p < .001$, and Cramer's V = .143. One out of three students attending community college are first generation (AACC, 2016), which aligns with the college enrollment patterns seen here.

Differences in enrollment across institutional type were found to be statistically significant for students based on the percentage of free and reduced-price lunch participation at the high school where they graduated, Welch's $F(1, 11612.411) = 355.164$, $p < .001$. Dual enrollment students who enrolled in two-year institutions graduated from high schools with an average percentage of their high school receiving free and reduced-price lunch nearly 5 percentage points higher than the average for DE students who enrolled in four-year institutions (see Table 22). This outcome suggests that DE students who graduate from high schools with a greater proportion of students assumed to be from lower income families are more likely to enroll in a two-year institution than a four-year institution. Two-year institutions, the majority of which are community colleges, are often seen as a low-cost alternative to four-year institutions because of historically lower tuition rates (Cohen et al., 2013), making them more affordable for low-income families.

Table 22

Average Percentage of High School Receiving Free and Reduced-Price Lunch by Institutional Type

Variable	Missing	%	*n*	*M*	*Mdn*	*SD*
Total	524	3.27	15,495	35.51%	34.56%	15.2%
Institutional Type						
2-year	288	5.08	5,380	38.58%	38.77%	14.4%
4-year	236	2.28	10,115	33.89%	31.02%	15.4%

A chi-square was also performed and the free and reduced-price lunch variable was found to be statistically significant, $\chi^2(3, n = 15{,}495) = 310.775$, $p < .001$, and Cramer's V = .142, for the institutional type in which DE students enrolled. The pattern varied with students in the lowest and highest ranges (<25% and >75% free and reduced-price lunch participation, respectively) deviating from the overall sample in terms of higher enrollment rates at four-year institutions (see Table 19). Dual enrollment students from high schools with 50-74% of students receiving free and reduced-price lunch enrolled in two-year institutions at a higher rate than the overall sample of DE students, and students within this range contributed to the statistically significant difference as shown in Table 23. Students within the lowest range (<25% free and reduced-price lunch participation) also contributed to the statistically significant difference, enrolling in four-year institutions at a greater rate than expected and the overall sample. The pattern here is similar to the one revealed in the relationship between the free and reduced-price lunch variable and enrollment in college.

Table 23

Crosstabulation of Institutional Type and Ranges for Free and Reduced-Price Lunch Percentages

	Range for Free and Reduced-Price Lunch Percentages			
Institutional Type	<25%	25-49%	50-74%	>75%
2-year	1073 (24.7%) (-16.4)	2822 (36.8%) (5.4)	1474 (42.9%) (11.4)	11 (23.9%) (-1.5)
4-year	3271 (75.3%) (16.4)	4847 (63.2%) (-5.4)	1962 (57.1%) (-11.4)	35 (76.1%) (1.5)

Note. Adjusted residuals appear in parentheses below observed frequencies

Lower family income, as measured by a higher participation in free and reduced-price lunch at student's high school, is associated with higher enrollment rates in four-year institutions. The same is true for students from higher family income, as measured by a lower participation in free and reduce lunch program. These results might reflect the effort of four-year institutions to provide additional financial assistance for students from backgrounds with lower family income.

The type of institution in which DE students enrolled was statistically significant across each of the five student demographic variables. The postsecondary education patterns illustrated here align with the traditional view of which students enroll in two-year institutions: students from minority backgrounds, first generation, and lower-income families.

The results presented in this section analyzed the postsecondary educational patterns of Virginia DE students who graduated from high school in 2012 for five student demographic variables. Statistically significant results were found for all five student demographics across three dependent variables with only two exceptions. Student's age

when first enrolled in DE was not found to be statistically significant across enrollment in college or timing of college enrollment. However, age was statistically significant across institutional type. The next section covers a similar line of inquiry across six academic metrics variables.

Research Question 2: Academic Metrics

Similar to the first research question, the second question also examined descriptive differences in Virginia DE students across identified academic metrics according to their enrollment in college after high school graduation. Identified academic metrics included variables for first term enrolled in DE (i.e., grade in high school when student first enrolled), total terms enrolled in DE, total DE credits attempted and completed, total college transfer credits attempted and completed, total career and technical education credits (CTE) attempted and completed, total DE credits attempted and completed based on academic year, and community college award. The following research question and subset questions were explored:

2. What are identified academic metrics of high school dual enrollment students who enrolled in postsecondary education and those who did not enroll?
    a. How are academic metrics of dual enrollment students who enrolled and those who did not enroll in postsecondary education different?
    b. How are academic metrics of dual enrollment students who immediately enrolled and those who delayed enrollment in postsecondary education different?

c. How are academic metrics of dual enrollment students who enrolled in two-year institutions and those who enrolled in four-year institutions different?

Again, results for this set of research questions are presented in the following section, focusing on six academic metrics variables.

Academic metrics of Virginia DE students. For each academic metric variable, counts and percentages are summarized in Table 24. For purposes of reporting counts and percentages of the total (N = 18,862), the variables for total DE credits attempted and completed were broken into six ranges: (a) 0 credits, (b) <6 credits, (c) 6-11 credits, (d) 12-17 credits, (e) 18-23 credits, and (f) >24 credits. These ranges align with Adelman's (2006) premise that students who completed a threshold of college credits were more likely to enroll in and complete college: "Six is good, 9 is better, 12 is a guarantee of momentum" (p. xx). Using these same ranges, credits attempted and completed were also analyzed per credit type and per academic year (see Table 25).

Using the term in which students first enrolled in a DE course, the student's grade level in high school was assumed to be freshman when he/she first enrolled in DE in fall 2008 or spring 2009; sophomore when first enrolled in summer 2009, fall 2009 or spring 2010; junior when first enrolled in summer 2010, fall 2010 or spring 2011; and senior when first enrolled in summer 2001, fall 2011 or spring 2012. Based on these assumptions, the majority of students (85%) enrolled in a DE course when they were either a junior (41%) or senior (44%) in high school. Higher percentages of high school juniors and seniors enrolling in a DE course for the first time adheres to the *Virginia Plan*

Table 24

Academic Metrics of Virginia DE Students by Enrollment in College

Variable	Enrolled		Did Not Enroll		Total	
	n	%	*n*	%	*N*	%
Total	16,019	84.93	2,843	15.07	18,862	100.00
First term enrolled in DE***						
Freshman	658	77.14	195	22.86	853	4.52
Sophomore	1,593	81.48	362	18.52	1,955	10.36
Junior	6,579	84.82	1,177	15.18	7,756	41.12
Senior	7,189	86.64	1,109	13.36	8,298	43.99
Total terms enrolled in DE***						
1	4,028	78.02	1,135	21.98	5,163	27.37
2	6,562	85.95	1,073	14.05	7,635	40.48
3	1,655	87.06	246	12.94	1,901	10.08
4	2,843	90.57	296	9.43	3,139	16.64
5	420	88.79	53	11.21	473	2.51
6	333	93.02	25	6.98	358	1.90
7	120	90.23	13	9.77	133	0.71
8	55	96.49	2	3.51	57	0.30
9	2	100.00	0	0.00	2	0.01
10	1	100.00	0	0.00	1	0.01
Total DE credits attempted***						
1-5 credits	3,038	77.58	878	22.42	3,916	20.76
6-11 credits	6,004	83.64	1,174	16.36	7,178	38.06
12-17 credits	2,937	87.10	435	12.90	3,372	17.88
18-23 credits	1,647	91.25	158	8.75	1,805	9.57
>24 credits	2,393	92.36	198	7.64	2,591	13.74
Total DE credits completed***						
1-5 credits	3,255	76.62	993	23.38	4,248	22.52
6-11 credits	5,962	83.98	1,137	16.02	7,099	37.64
12-17 credits	2,897	87.66	408	12.34	3,305	17.52
18-23 credits	1,637	92.23	138	7.77	1,775	9.41
>24 credits	2,268	93.14	167	6.86	2,435	12.91
GPA***						
<2.0	810	66.28	412	33.72	1,222	6.48
2.00-2.49	1,571	75.60	507	24.40	2,078	11.02
2.50-2.99	1,918	86.05	311	13.95	2,229	11.82
3.00-3.49	4,481	85.48	761	14.52	5,242	27.79
3.50-3.99	3,112	91.80	278	8.20	3,390	17.97
>4.0	4,127	87.79	574	12.21	4,701	24.92
Award***						
Career Studies Certificate	77	75.49	25	24.51	102	0.54
Certificate	36	85.71	6	14.29	42	0.22
Degree	118	93.65	8	6.35	126	0.67
Certificate + Degree	115	91.27	11	8.73	126	0.67
No Award	15,673	84.87	2,793	15.13	18,466	97.90

***$p < .001$

for Dual Enrollment (Virginia Plan) that was in effect in 2008. In the 2008 Virginia Plan, participation in DE was restricted to juniors and seniors, but allowed freshman and sophomore students to be considered for DE upon sufficient demonstration of college readiness and approval by high school and community college leadership (VCCS, 2008). Therefore, we would expect that the majority of DE students first enrolled in DE as high school juniors or seniors.

The total number of terms in which students enrolled in DE ranged from one to 10 terms, and included summer terms in 2009, 2010, and 2011. The majority of DE students (95%) enrolled in four or fewer terms, which supports the reported figures for grade in high school when students first enrolled in DE. Given that high school students typically did not enroll in DE until their junior or senior year, one would expect that the majority of students would complete four or fewer terms.

The total number of DE credits attempted is the sum of all DE credits in which a student enrolled and then the total number of DE credits completed is the sum of those credits a student successfully completed while in high school. In this sample of DE students, no student completed zero credits—all students completed at least one DE credit. This does not mean, however, that students completed all credits attempted. There were 1,469 students (approximately 8% of the sample) who completed fewer credits than they attempted. Speaking to credits completed, 41% of DE students completed 12 or more credits, a "guarantee of momentum" according to Adelman (2006, p. xx). Another 38% completed between six and 11 credits, which is also supported by Adelman's assertion that six credits was a good indication of momentum and nine credits was an even better indication. These results, therefore, show that 79% of Virginia DE

students earned DE credits equivalent to ensuring academic momentum toward completing a college degree (i.e., six credits or more).

The data available allowed me to also examine total DE credits attempted and total DE credits completed by credit type and by academic year. Typically, DE credits are classified as college transfer credits when they facilitate transfer to a four-year institution for baccalaureate programs and as CTE credits when they are a part of certificate and diploma programs designed for gainful employment. As reported in Table 25, 70% of DE students completed college transfer credits and 61% completed CTE credits. The sum for each credit type includes duplicated counts for 5,690 students, or 30% of the sample, who completed both college transfer and CTE credits. Within the counts for a specific credit type, only those students who attempted at least one credit in the respective credit type are included for that credit type. For example, students who did not attempt any college transfer credits are excluded from the counts for college transfer credits to prevent them from being counted as completing zero college transfer credits when in fact they had not attempted any college transfer credits and therefore, would be expected to have completed zero credits. The same is true for students who did not attempt any CTE credits as well. As mentioned previously, there were no students in the sample who completed zero credits, so all students are included in the counts below in at least one of the credit type categories and some are in both, and for those students shown as completing zero credits indicates that they completed fewer credits than they attempted.

Table 25

Ranges of Total Credits Completed by Virginia DE Students by Credit Type and Academic Year (AY)

Variable	Enrolled		Did Not Enroll		Total	
	n	%	*n*	%	*N*	%
Total DE Credits	16,019	84.93	2,843	15.07	18,862	100.00
College Transfer Credits	12,101	91.33	1,149	8.67	13,250	70.25
0 credits	65	65.00	35	35.00	100	0.75
1-5 credits	2,128	85.09	373	14.91	2,501	18.88
6-11 credits	5,207	91.74	469	8.26	5,676	42.84
12-17 credits	2,341	93.94	151	6.06	2,492	18.81
18-23 credits	1033	95.21	52	4.79	1,085	8.19
>24 credits	1,327	95.06	69	4.94	1,396	10.54
CTE Credits	9,310	80.84	2,207	19.16	11,517	61.06
0 credits	92	80.00	23	20.00	115	1.00
1-5 credits	2,959	76.96	886	23.04	3,845	33.39
6-11 credits	4,543	83.27	913	16.73	5,456	47.37
12-17 credits	1,140	81.20	264	18.80	1,404	12.19
18-23 credits	371	85.09	65	14.91	436	3.79
>24 credits	205	78.54	56	21.46	261	2.27
AY 2008-09	658	77.14	195	22.86	853	4.52
0 credits	4	33.33	8	66.67	12	1.41
1-5 credits	441	75.00	147	25.00	588	68.93
6-11 credits	207	85.19	36	14.81	243	28.49
12-17 credits	4	57.14	3	42.86	7	0.82
18-23 credits	2	66.67	1	33.33	3	0.35
>24 credits	0	0.00	0	0.00	0	0.00
AY 2009-10	1,847	81.33	424	18.67	2,271	12.04
0 credits	16	53.33	14	46.67	30	1.32
1-5 credits	914	78.73	247	21.27	1,161	51.12
6-11 credits	728	84.06	138	15.94	866	38.13
12-17 credits	95	83.33	19	16.67	114	5.02
18-23 credits	77	92.77	6	7.23	83	3.65
>24 credits	17	100.00	0	0.00	17	0.75
AY 2010-11	7,652	85.58	1,289	14.42	8,941	47.40
0 credits	87	79.82	22	20.18	109	1.22
1-5 credits	1,753	78.57	478	21.43	2,231	24.95
6-11 credits	3,936	87.14	581	12.86	4,517	50.52
12-17 credits	1025	87.61	145	12.39	1,170	13.09
18-23 credits	452	93.58	31	6.42	483	5.40
>24 credits	399	92.58	32	7.42	431	4.82

Variable	Enrolled		Did Not Enroll		Total	
	n	%	*n*	%	*N*	%
AY 2011-12	13,352	87.41	1,923	12.59	15,275	80.98
0 credits	73	64.04	41	35.96	114	0.75
1-5 credits	2,948	80.68	706	19.32	3,654	23.92
6-11 credits	5,945	87.71	833	12.29	6,778	44.37
12-17 credits	2,436	91.75	219	8.25	2,655	17.38
18-23 credits	975	93.30	70	6.70	1,045	6.84
>24 credits	975	94.75	54	5.25	1,029	6.74

Note. The sum total of students by credit type and academic year exceeds $N = 18,862$ because some students completed credits in more than one credit type and/or academic year

A larger percentage of students completed 12 or more college transfer credits (38%) than students who completed 12 or more CTE credits (18%). The number of students who completed zero CTE credits (i.e., they attempted more CTE credits than they completed, $n = 116$) was greater than the number of students who completed zero college transfer credits ($n = 100$). The distinction between credit types becomes more consequential in the upcoming analysis when comparing college enrollment rates by total DE credits in each credit type.

Similar to total DE credits attempted and completed by credit type, Table 25 also reports the ranges of credits completed by DE students by academic year (AY). These data show differences in the number of students completing a range of credits each academic year throughout the timeframe of this study (i.e., student's high school experience). Dual enrollment students completed more credits per academic year in their junior and senior year. In AY 2008-09 (freshman year), only three DE students completed 18 or more credits and in AY 2009-10 (sophomore year), the number of students who completed 18 or more credits equaled 100. The number of students increased significantly in AY 2010-11 (junior year) when 914 DE students completed 18 or more credits and in AY 2011-12 (senior year) when 2,074 students did. Traditionally,

DE programs have been perceived as an opportunity to provide a more rigorous and challenging curriculum for high school students who had exhausted their high school's course offerings (Karp & Jeong, 2008). With a growing interest to make the most of the high school senior year (see Hoffman et al., 2008; Vargas, 2015), it stands to reason that the number of DE credits completed by high school seniors was greater than credits completed by high school students in other grade levels.

Students' grade point averages in DE courses ranged from 0.10 to 4.0, and were based on a 4.0 scale. One-fourth of DE students earned a 4.0 in their DE coursework and nearly half (46%) earned a 3.0 or higher. These data indicate that nearly three out of four students in the sample were high-achievers in terms of their academic performance as measured by their GPA in DE coursework.

Although uncommon, it is possible for a DE student to graduate from college with a community college award (e.g., certificate and/or degree) prior to graduating from high school. In this sample of DE students, the majority did not earn an award before graduating high school. However, 2% (n = 396) did earn an award and one third of these students earned two awards, a degree and a certificate.

Academic metrics of Virginia DE students by enrollment in college. The academic metrics of DE students who enrolled in college were compared to those who did not enroll in college to determine whether differences existed between the two groups. Tables 24 and 25 present the counts and percentages of the total for each academic metrics variable and Table 27 presents the measures of central tendency for each academic metrics variable that is a continuous data type. As reported in the results for the first research question in the previous section, 85% of DE students enrolled in

college and 15% did not enroll. The discussion that follows highlights deviations from this college enrollment pattern across each academic metrics variable.

Dual enrollment students who first enrolled in DE as high school freshmen and sophomores enrolled in college at rates lower than the overall sample, 77% and 81% compared to 85%. For high school seniors starting DE for the first time, they enrolled in college at a slightly higher rate (87%) than all DE students. These differences are also reflected in the results of the chi-square that was conducted, $\chi^2(3, N = 18{,}862) = 77.504$, $p < .001$. Although the association was rather small, Cramer's V = .064, the results were statistically significant. Freshmen, sophomores, and seniors are shown in Table 26 as contributing to the significant difference.

Table 26

Crosstabulation of College Enrollment and First Term Enrolled in DE

College Enrollment	First Term Enrolled in DE			
	Freshman (2008-09)	Sophomore (2009-10)	Junior (2010-11)	Senior (2011-12)
Enrolled	658 (77.1%) (-6.5)	1593 (81.5%) (-0.3)	6579 (84.8%) (5.8)	7189 (86.6%) (-4.5)
Did Not Enroll	195 (22.9%) (6.5)	362 (18.5%) (0.3)	1177 (15.2%) (-5.8)	1109 (13.4%) (4.5)

Note. Adjusted residuals appear in parentheses below observed frequencies

An ANOVA was performed to measure the difference in the number of terms enrolled in DE between students who enrolled and did not enroll in college. On average, students who enrolled in college had been enrolled in DE for 0.42 more terms, which reveals a rather small difference even though it was found to be statistically significant. Due to violations in the assumption of equal variances ($F = 3.587$, $p < .001$), Welch's

ANOVA was interpreted, indicating an association between college enrollment and the number of DE terms in which a student was enrolled in DE.

A breakdown of the number of credits attempted and completed in total, for each credit type (e.g., college transfer and CTE), and for each academic year is presented in Table 25. Here the gap between students who enrolled in college and students who did not in terms of the number of credits completed becomes more apparent. For all classifications, the difference between average number of credits attempted and completed was less than one for both college goers and non-college goers. In Table 27, I include a breakdown of credits attempted and completed to report the statistical significance of each variable and focus the narrative on DE credits completed.

Students who enrolled in college completed more DE credits than students who did not enroll in college, a statistically significant difference using Welch's ANOVA. Of college enrollers, 43% completed 12 or more DE credits and another 37% completed between six and 11 credits. Of non-college enrollers, only 25% completed 12 or more DE credits and 40% completed between six and 11 credits. The difference in the total number of DE credits completed between the two groups was approximately four credits on average, or a little more than one course assuming a typical college course equivalent to three credits. The difference in DE credits completed between college goers and non-college goers was 3.26 for college transfer credits (Welch's ANOVA) and 0.26 for CTE credits (ANOVA), suggesting a potentially important distinction between credit types in college enrollment.

The largest difference between the number of DE credits completed in an academic year between college goers and non-college goers was in AY 2010-11 and AY

2011-12, or the junior and senior years of high school respectively. Dual enrollment students who enrolled in college earned nearly two more credits in their junior year and three more credits in their senior year than students who did not enroll in college. These data show a higher number of credits completed by DE students in their junior and senior year for both college goers and non-college goers.

Students' GPA in DE courses were reported in ranges in Table 24, which helped illustrate lower college enrollment rates of DE students who earned less than a 3.00 GPA, 78% compared to 85% for the overall sample. Students who earned 3.00 GPA and higher were more likely to enroll in college. On average, DE students who enrolled in college earned 0.38 higher GPA than non-college goers, as presented in Table 27. Although there were outliers in the analysis and the distribution was not normal, the large sample size and robustness of the ANOVA helped to minimize sensitivity to these violations. Still the Welch's ANOVA was interpreted and found to be statistically significant, suggesting that higher-performing DE students were more likely to enroll in college.

College enrollment rates for DE students who earned a community college award were slightly higher (87%) than for those who did not earn an award and the overall sample (both 85%). Specifically, for students who earned an associate degree and those who earned both an associate degree and certificate college enrollment rates exceeded those who did not earn an award and the overall sample, 91% compared to 85%. One possible reason the remaining 13% of DE students graduating high school with a college credential might not have enrolled in college after high school graduation is because they did not require any additional education and training beyond the credential they already earned. The purpose of this study did not lend itself to exploring the plausibility of this

reason; however, it does highlight a statistically significant difference in college enrollment across community college awards, $\chi^2(4, N = 18{,}862) = 18.607$, $p < .001$, with a small association, Cramer's V = .031. The adjusted residuals reported in Table 28 point to degree earners and certificate/degree earners as major contributors to statistical significance. Students who earned a Career Studies Certificate (CSC) are an exception to the relationship between award and college enrollment as we see a higher percentage did not enroll in college (25%) when compared to other award earners (13%) and the overall sample (15%). The CSC is marketed for entry into the workforce, so it stands to reason that students who earn a CSC are less likely to enroll in college due to the type of certificate earned.

Table 27

Average Academic Metrics of Virginia DE Students by Enrollment in College

Variable	College Enrollment	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
	n = 18,862	2.37	2.00	1.3	9	(293.144)	.001
Total terms enrolled in DE***	Enrolled	2.43	2.00	1.3	9		
	Did Not Enroll	2.01	2.00	1.2	7		
Total DE Credits	*n* = 18,862						
Attempted***		13.02	8.00	13.0	96	(349.012)	.001
Completed***		12.67	8.00	12.8	96	(431.480)	.001
Attempted	Enrolled	13.62	9.00	13.4	96		
Completed		13.31	9.00	13.2	96		
Attempted	Did Not Enroll	9.68	6.00	9.7	83		
Completed		9.07	6.00	9.3	83		
College Transfer	*n* = 13,250						
Attempted***		11.90	7.00	11.0	76	(89.092)	.001
Completed***		11.59	6.00	10.8	75	(120.901)	.001
Attempted	Enrolled	12.15	8.00	11.4	76		
Completed		11.87	7.00	10.9	75		
Attempted	Did Not Enroll	9.28	6.00	9.7	63		
Completed		8.61	6.00	9.5	64		
Career/Technical Ed (CTE)	*n* = 11,517						
Attempted		7.64	6.00	5.7	57	.000	.996
Completed		7.41	6.00	5.6	55	3.764	.052
Attempted	Enrolled	7.64	6.00	5.6	57		
Completed		7.46	6.00	5.6	55		
Attempted	Did Not Enroll	7.64	6.00	6.0	47		
Completed		7.20	6.00	5.8	48		
AY 2008-09	*n* = 853						
Attempted		4.23	3.00	2.1	19	2.775	.096
Completed**		4.15	3.00	2.2	20	7.218	.007

Variable	College Enrollment	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
AY 2008-09 (cont.)							
Attempted	Enrolled	4.29	3.00	2.1	19		
Completed		4.26	3.00	2.1	20		
Attempted	Did Not Enroll	4.01	3.00	2.3	19		
Completed		3.79	3.00	2.3	20		
AY 2009-10	*n* = 2,271						
Attempted***		5.38	4.00	4.4	34	(21.107)	.001
Completed***		5.27	4.00	4.4	34	(31.815)	.001
Attempted	Enrolled	5.54	4.00	4.5	34		
Completed		5.46	4.00	4.5	34		
Attempted	Did Not Enroll	4.69	4.00	3.4	23		
Completed		4.41	4.00	3.4	23		
AY 2010-11	*n* = 8,942						
Attempted***		7.78	6.00	6.8	44	(145.219)	.001
Completed***		7.58	6.00	6.8	42	(167.152)	.001
Attempted	Enrolled	8.08	6.00	7.0	44		
Completed		7.90	6.00	6.9	42		
Attempted	Did Not Enroll	6.13	6.00	5.5	36		
Completed		5.84	6.00	6.4	36		
AY 2011-12	*n* = 15,270						
Attempted***		9.31	6.00	7.8	55	(296.476)	.001
Completed***		9.05	6.00	7.7	55	(393.188)	.001
Attempted	Enrolled	9.66	6.00	7.9	55		
Completed		9.43	6.00	7.8	55		
Attempted	Did Not Enroll	7.03	6.00	6.4	51		
Completed		6.52	6.00	6.1	48		
GPA***	*n* = 18,862	3.14	3.25	0.8	3.90	(425.080)	.001
	Enrolled	3.20	3.33	0.7	3.90		
	Did Not Enroll	2.82	3.00	0.9	3.82		

**$p < .01$, ***$p < .001$

Table 28

Crosstabulation of College Enrollment and Community College Award

College Enrollment	Community College Award				
	Career Studies Certificate	Certificate	Certificate + Degree	Degree	No Award
Enrolled	77 (75.5%) (-2.7)	36 (85.7%) (0.1)	115 (91.3%) (2.0)	118 (93.7%) (2.7)	15673 (84.9%) (-1.4)
Did Not Enroll	25 (24.5%) (2.7)	6 (14.3%) (-0.1)	11 (8.7%) (-2.0)	8 (6.3%) (-2.7)	2793 (15.1%) (1.4)

Note. Adjusted residuals appear in parentheses below observed frequencies

In the next section, I performed a second layer of analysis on the group of DE students who enrolled in college to explore potential differences across each academic metrics variable in the timing of their enrollment in college. Results of these analyses are presented in tables and discussed in order as they appear in Table 29.

Academic metrics of Virginia DE students who enrolled in college by timing of college enrollment. Following the presentation of college enrollment rates of the sample DE students, this section focuses on the timing of college enrollment of those who enrolled in college after high school graduation. Students who enrolled in college in summer or fall 2012 were categorized as enrolling immediately and included 89% of the sample DE students. Students who enrolled in a subsequent semester between spring 2013 and fall 2015 were categorized as delaying enrollment and included 11% of the sample. Results of the data analyses were statistically significant for all academic metrics variables at the aggregate level (e.g., total DE credits attempted and completed), and are reported in Table 29. At a more disaggregated level, there were only three non-

Table 29

Academic Metrics of Virginia DE Students who Enrolled in College by Timing of College Enrollment

Variable	Immediate (by Fa 2012)		Delayed (Sp 2013-Fa 2015)		Total	
	n	%	*n*	%	*n*	%
Total	14,204	88.67	1,815	11.33	16,019	100.00
First term enrolled in DE***						
Freshman	555	84.35	103	15.65	658	4.11
Sophomore	1,415	88.83	178	11.17	1,593	9.94
Junior	5,937	90.24	642	9.76	6,579	41.07
Senior	6,297	87.59	892	12.41	7,189	44.88
Total terms enrolled in DE***						
1	3,404	84.51	624	15.49	4,028	25.15
2	5,805	88.46	757	11.54	6,562	40.96
3	1,497	90.45	158	9.55	1,655	10.33
4	2,643	92.97	200	7.03	2,843	17.75
5	383	91.19	37	8.81	420	2.62
6	306	91.89	27	8.11	333	2.08
7	110	91.67	10	8.33	120	0.75
8	53	96.36	2	3.64	55	0.34
9	2	100.00	0	0.00	2	0.01
10	1	100.00	0	0.00	1	0.01
Total DE credits attempted***						
1-5 credits	2,570	84.60	468	15.40	3,038	18.96
6-11 credits	5,236	87.21	768	12.79	6,004	37.48
12-17 credits	2,651	90.26	286	9.74	2,937	18.33
18-23 credits	1,519	92.23	128	7.77	1,647	10.28
>24 credits	2,228	93.10	165	6.90	2,393	14.94
Total DE credits completed***						
1-5 credits	2,721	83.59	534	16.41	3,255	20.32
6-11 credits	5,210	87.39	752	12.61	5,962	37.22
12-17 credits	2,641	91.16	256	8.84	2,897	18.08
18-23 credits	1,511	92.30	126	7.70	1,637	10.22
>24 credits	2,121	93.52	147	6.48	2,268	14.16
GPA***						
<2.0	592	73.09	218	26.91	810	5.06
2.00-2.49	1,299	82.69	272	17.31	1,571	9.81
2.50-2.99	1,694	88.32	224	11.68	1,918	11.97
3.00-3.49	3,980	88.82	501	11.18	4,481	27.97
3.50-3.99	2,874	92.35	238	7.65	3,112	19.43
>4.0	3,765	91.23	362	8.77	4,127	25.76
Award**						
Career Studies Certificate	62	80.52	15	19.48	77	0.48
Certificate	33	91.67	3	8.33	36	0.22
Degree	112	94.92	6	5.08	118	0.74
Certificate + Degree	111	96.52	4	3.48	115	0.72
No Award	13,886	88.60	1,787	11.40	15,673	97.84

**$p < .01$, ***$p < .001$

significant results: one for credits attempted for one credit type (i.e., CTE credits) and two for credits attempted and completed in one particular academic year (i.e., 2008-09). These results are reported in Table 30, along with *F* and *p* values for ANOVA and Welch's ANOVA when there are unequal variances.

The majority of DE students first enrolled in DE as high school juniors and seniors, and those who first enrolled as juniors were more likely to immediately enroll in college after graduating high school (90%) than those who first enrolled as seniors (88%) and the overall sample (89%). The differences were found to be statistically significant, $\chi^2(3, n = 16{,}019) = 17.132$, $p < .001$, and Cramer's V = .048, although the association is relatively small. The immediate college enrollment rate of DE students who first enrolled in DE as juniors was a major contributor to the statistical significance as reported in the adjusted residuals in Table 31.

Table 30

Average Academic Metrics of Virginia DE Students by Timing of College Enrollment

Variable	Timing of Enrollment	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
	n = 16,019	2.43	2.00	1.3	9	(131.162)	.000
Total terms enrolled in DE***	Immediate	2.47	2.00	1.3	9		
	Delayed	2.12	2.00	1.2	7		
Total DE Credits	*n* = 16,019						
Attempted***		13.62	9.00	13.4	96	(144.040)	.000
Completed***		13.31	9.00	13.2	96	(179.057)	.000
Attempted	Immediate	13.99	9.00	13.7	96		
Completed		13.71	9.00	13.5	96		
Attempted	Delayed	10.70	6.00	10.6	80		
Completed		10.13	6.00	10.3	80		
College Transfer	*n* = 11,066						
Attempted***		12.15	8.00	11.4	76	(48.223)	.000
Completed***		11.87	7.00	10.9	75	(66.102)	.000
Attempted	Immediate	12.34	6.00	11.1	76		
Completed		12.09	6.00	11.0	75		
Attempted	Delayed	10.13	6.00	9.6	72		
Completed		9.55	6.00	9.5	69		
Career/Technical Ed (CTE)	*n* = 8,098						
Attempted		7.64	6.00	5.6	57	3.331	.068
Completed**		7.46	6.00	5.6	55	(9.690)	.002
Attempted	Immediate	7.68	6.00	5.6	57		
Completed		7.53	6.00	5.6	55		
Attempted	Delayed	7.36	6.00	5.5	44		
Completed		7.01	6.00	5.3	45		
AY 2008-09	*n* = 555						
Attempted		4.29	3.00	2.1	19	.108	.742
Completed		4.26	3.00	2.1	20	.935	.334

Variable	Timing of Enrollment	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
AY 2008-09 (cont.)							
Attempted	Immediate	4.31	3.00	2.0	17		
Completed		4.30	3.00	2.0	17		
Attempted	Delayed	4.23	3.00	2.3	19		
Completed		4.08	3.00	2.5	20		
AY 2009-10	*n* = 1,799						
Attempted**		5.54	4.00	4.5	34	7.772	.005
Completed***		5.46	4.00	4.5	34	10.443	.001
Attempted	Immediate	5.64	4.00	4.6	34		
Completed		5.58	4.00	4.6	34		
Attempted	Delayed	4.78	4.00	4.2	30		
Completed		4.58	4.00	4.2	27		
AY 2010-11	*n* = 7,561						
Attempted***		8.08	6.00	7.0	44	(39.295)	.000
Completed***		7.90	6.00	6.9	42	(48.521)	.000
Attempted	Immediate	8.23	6.00	7.1	44		
Completed		8.06	6.00	7.0	42		
Attempted	Delayed	6.81	6.00	6.2	39		
Completed		6.49	6.00	6.1	39		
AY 2011-12	*n* = 12,552						
Attempted***		9.66	6.00	7.9	55	(110.350)	.000
Completed***		9.43	6.00	7.8	55	(151.117)	.000
Attempted	Immediate	9.87	6.00	8.0	55		
Completed		9.67	6.00	7.9	55		
Attempted	Delayed	7.92	6.00	6.7	45		
Completed		7.46	6.00	6.5	42		
GPA***	*n* = 16,019	3.20	3.33	0.7	3.90	(221.385)	.000
	Immediate	3.24	3.36	0.7	3.8		
	Delayed	2.91	3.00	0.9	3.9		

**$p < .01$, ***$p < .001$

Table 31

Crosstabulation of Timing of Enrollment and First Term Enrolled in DE

Timing of Enrollment	First Term Enrolled in DE			
	Freshman (2008-09)	Sophomore (2009-10)	Junior (2010-11)	Senior (2011-12)
Immediate	555 (84.3%) (-3.6)	1415 (88.8%) (0.2)	5937 (90.2%) (5.2)	6297 (87.6%) (-3.9)
Delayed	103 (15.7%) (3.6)	178 (11.2%) (-0.2)	642 (9.8%) (-5.2)	892 (12.4%) (3.9)

Note. Adjusted residuals appear in parentheses below observed frequencies

Students who were enrolled in DE for only one or two terms were more likely to delay enrollment in college, although only slightly, than students who enrolled in DE for three or more terms. The difference in the average number of terms enrolled in DE is the equivalent of one-third of a term (0.35), so the difference is relatively small. However, the counts and percentages of the total in Table 29 might provide more meaningful comparisons, showing a more dramatic increase in immediate enrollment rates for students who were enrolled for four (93%) and eight terms (96%).

Students who completed less than 12 DE credits were almost twice as likely to delay enrollment (14%) than students who completed 12 or more DE credits (8%). The average difference in credits completed between DE students who immediately enrolled and delayed enrollment was 3.58 credits. The difference in credits completed decreases when broken down by credit type, 2.54 for college transfer credits and 0.52 for CTE credits. Across the four academic years, the largest difference in credits completed

between immediate and delayed college enrollers was in AY 2011-12, or students' senior year, a difference of 2.21 credits.

Similar to the results for enrollment in college, higher GPA in DE courses were associated with higher immediate college enrollment rates. Students with a 3.00 GPA and higher made up 75% of immediate college enrollers, but only made up 61% of delayed enrollers. The average difference in GPA for students who enrolled immediately compared to those who delayed enrollment was 0.33.

Students who earned a community college award prior to completing high school were more likely enroll in college by the fall semester after high school graduation. Associate degree earners enrolled immediately (95%) and certificate plus associate degree earners enrolled immediately (97%) compared to the over sample enrolling immediately (89%). Students earning two awards contributed primarily to this statistical significant difference, $\chi^2(4, n = 16{,}019) = 17.132$, $p = .002$, and Cramer's V = .033. Again, the CSC earners pulled the difference in a slightly different direction with

Table 32

Crosstabulation of Timing of Enrollment and Community College Award

Timing of Enrollment	Community College Award				
	Career Studies Certificate	Certificate	Certificate + Degree	Degree	No Award
Immediate	62 (80.5%) (-2.3)	33 (91.7%) (0.6)	111 (96.5%) (2.7)	112 (94.9%) (2.1)	13886 (88.6%) (-1.9)
Delayed	15 (19.5%) (2.3)	3 (8.3%) (-0.6)	4 (3.5%) (-2.7)	6 (5.1%) (-2.1)	1787 (11.4%) (1.9)

Note. Adjusted residuals appear in parentheses below observed frequencies

fewer students enrolling immediately than expected, for a reason that is not easily explained by the data presented here in this study.

A further look at the timing of college enrollment for the sample DE students suggest that students who completed more credits, and particularly college transfer credits, earned higher GPAs, and were awarded a certificate and/or degree were more likely to enroll immediately in college and therefore, less likely to delay enrollment. The next unit of analysis is the institutional type in which these students enrolled.

Academic metrics of Virginia DE students who enrolled in college by institutional type. Of the DE students in the sample who enrolled in college, 35% enrolled in a two-year institution and 65% enrolled in a four-year institution. The following analyses were performed to compare differences between these two groups across each academic metrics variable. As with the previous analyses, counts and percentages for nominal data and for ranges established for continuous data are reported in a single table, Table 33 and measures of central tendency are reported in Table 34.

Students who first enrolled in DE as high school seniors enrolled in two-year institutions at a slightly higher rate (37%) than the overall sample (35%), a statistically significant difference, $\chi^2(3, n = 16{,}019) = 17.249$, $p = .001$, with a small association, Cramer's V = .033 (see Table 35). The inverse was true for students who enrolled in DE as high school juniors. For these students, they enrolled in two-year institutions at a slightly lower rate (34%) than the overall sample, and thus were more likely to enroll in a four-year institution (66% compared to 65%). Again, these differences are relatively small.

Table 33

Academic Metrics of Virginia DE Students who Enrolled in College by Institutional Type

Variable	Enrolled in 2-yr		Enrolled in 4-yr		Total	
	n	%	*n*	%	*n*	%
Total	5,668	35.38	10,351	64.62	16,019	100.00
First term enrolled in DE***						
Freshman	238	36.17	420	63.83	658	4.11
Sophomore	565	35.47	1,028	64.53	1,593	9.94
Junior	2,209	33.58	4,370	66.42	6,579	41.07
Senior	2,656	36.95	4,533	63.05	7,189	44.88
Total terms enrolled in DE***						
1	1,682	41.76	2,346	58.24	4,028	25.15
2	2,266	34.53	4,296	65.47	6,562	40.96
3	600	36.25	1,055	63.75	1,655	10.33
4	842	29.62	2,001	70.38	2,843	17.75
5	145	34.52	275	65.48	420	2.62
6	106	31.83	227	68.17	333	2.08
7	20	16.67	100	83.33	120	0.75
8	6	10.91	49	89.09	55	0.34
9	0	0.00	2	100.00	2	0.01
10	1	100.00	0	0.00	1	0.01
Total DE credits attempted***						
1-5 credits	1,206	39.70	1,832	60.30	3,038	18.96
6-11 credits	2,204	36.71	3,800	63.29	6,004	37.48
12-17 credits	1,011	34.42	1,926	65.58	2,937	18.33
18-23 credits	544	33.03	1,103	66.97	1,647	10.28
>24 credits	703	29.38	1,690	70.62	2,393	14.94
Total DE credits completed***						
1-5 credits	1,335	41.01	1,920	58.99	3,255	20.32
6-11 credits	2,181	36.58	3,781	63.42	5,962	37.22
12-17 credits	982	33.90	1,915	66.10	2,897	18.08
18-23 credits	530	32.38	1,107	67.62	1,637	10.22
>24 credits	640	28.22	1,628	71.78	2,268	14.16
GPA***						
<2.0	480	59.26	330	40.74	810	5.06
2.00-2.49	787	50.10	784	49.90	1,571	9.81
2.50-2.99	747	38.95	1,171	61.05	1,918	11.97
3.00-3.49	1,654	36.91	2,827	63.09	4,481	27.97
3.50-3.99	858	27.57	2,254	72.43	3,112	19.43
>4.0	1,142	27.67	2,985	72.33	4,127	25.76
Award***						
Career Studies Certificate	46	59.74	31	40.26	77	0.48
Certificate	14	38.89	22	61.11	36	0.22
Degree	6	5.08	112	94.92	118	0.74
Certificate + Degree	9	7.83	106	92.17	115	0.72
No Award	5,593	35.69	10,080	64.31	15,673	97.84

***$p < .001$

Table 34

Average Academic Metrics of Virginia DE Students by Institutional Type

Variable	Institutional Type	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
Total terms enrolled in DE***	*n* = 16,019	2.43	2.00	1.3	9	(109.589)	.000
	Enrolled in 2-year	2.28	2.00	1.3	9		
	Enrolled in 4-year	2.51	2.00	1.4	8		
Total DE Credits	*n* = 16,019						
Attempted***		13.62	9.00	13.4	96	(144.040)	.000
Completed***		13.31	9.00	13.2	96	(179.057)	.000
Attempted	Enrolled in 2-year	12.00	8.00	10.5	82		
Completed		11.51	8.00	10.2	76		
Attempted	Enrolled in 4-year	14.50	9.00	14.7	96		
Completed		14.29	9.00	14.5	96		
College Transfer	*n* = 11,350						
Attempted***		12.15	8.00	11.4	76	(125.997)	.000
Completed***		11.87	7.00	10.9	75	(171.099)	.000
Attempted	Enrolled in 2-year	10.60	6.00	8.7	72		
Completed		10.10	6.00	8.5	69		
Attempted	Enrolled in 4-year	12.78	8.00	11.8	76		
Completed		12.60	8.00	11.7	75		
Career/Technical Ed (CTE)	*n* = 9,646						
Attempted**		7.64	6.00	5.6	57	8.649	.003
Completed		7.46	6.00	5.6	55	2.899	.089
Attempted	Enrolled in 2-year	7.84	6.00	5.7	57		
Completed		7.57	6.00	5.7	55		
Attempted	Enrolled in 4-year	7.49	6.00	5.5	54		
Completed		7.37	6.00	5.5	52		
AY 2008-09	*n* = 654						
Attempted		4.29	3.00	2.1	19	4.507	.034
Completed		4.26	3.00	2.1	20	(492.245)	.044

Variable	Institutional Type	*M*	*Mdn*	*SD*	*R*	*F*(Welch's)	*p*
AY 2008-09 (cont.)							
Attempted	Enrolled in 2-year	4.07	3.00	2.1	19		
Completed		4.04	3.00	2.1	20		
Attempted	Enrolled in 4-year	4.42	3.00	2.1	17		
Completed		4.39	3.00	2.1	18		
AY 2009-10	*n* = 1,736						
Attempted**		5.54	4.00	4.5	34	(55.171)	.000
Completed***		5.46	4.00	4.5	34	(61.801)	.000
Attempted	Enrolled in 2-year	4.63	4.00	3.6	29		
Completed		4.50	3.00	3.7	29		
Attempted	Enrolled in 4-year	6.04	5.00	4.9	34		
Completed		6.00	5.00	4.9	34		
AY 2010-11	*n* = 7,421						
Attempted***		8.08	6.00	7.0	44	(210.393)	.000
Completed***		7.90	6.00	6.9	42	(239.210)	.000
Attempted	Enrolled in 2-year	6.71	6.00	5.3	37		
Completed		6.46	6.00	5.2	35		
Attempted	Enrolled in 4-year	8.79	6.00	7.6	44		
Completed		8.64	6.00	7.6	42		
AY 2011-12	*n* = 13,210						
Attempted***		9.66	6.00	7.9	55	(73.588)	.000
Completed***		9.43	6.00	7.8	55	(114.637)	.000
Attempted	Enrolled in 2-year	8.93	6.00	7.0	50		
Completed		8.53	6.00	6.9	47		
Attempted	Enrolled in 4-year	10.07	6.00	8.3	55		
Completed		9.93	6.00	8.2	55		
GPA***	*n* = 16,019	3.20	3.33	0.7	3.90	(514.965)	.000
	Enrolled in 2-year	3.01	3.00	0.8	3.80		
	Enrolled in 4-year	3.30	3.50	0.7	3.90		

**$p < .01$, ***$p < .001$

Table 35

Crosstabulation of Institutional Type and First Term Enrolled in DE

Institutional Type	First Term Enrolled in DE			
	Freshman (2008-09)	Sophomore (2009-10)	Junior (2010-11)	Senior (2011-12)
Enrolled in 2-year	238 (36.2%) (0.4)	565 (35.5%) (0.1)	2209 (33.6%) (-4.0)	2656 (36.9%) (3.7)
Enrolled in 4-year	420 (63.8%) (-0.4)	1028 (64.5%) (-0.1)	4370 (66.4%) (4.0)	4533 (63.1%) (-3.7)

Note. Adjusted residuals appear in parentheses below observed frequencies

The largest deviation from the overall sample based on total terms enrolled in DE for enrollment and enrollment in a two-year institution exists for students who were enrolled in DE for only one term, 42% compared to 35%. The average difference equates to only 0.23 terms between DE students who enrolled in a two-year institution versus a four-year institution.

As presented previously, students who completed 12 or more DE credits were more likely to enroll in college and to enroll immediately. These students were also more likely to enroll in a four-year institution. In fact, 68% of students who completed 12 or more DE credits, enrolled in a four-year institution compared to 32% of students who enrolled in a two-year institution. A greater portion of DE students enrolled in a four-year institution who completed between six and 11 credits (63%) compared to those who enrolled in a two-year institution (37%). On average, students who enrolled in a four-year institution completed three more DE credits than students who enrolled in a two-year institution. The difference in credits completed between credit type was 2.5 for college transfer and 0.4 for CTE, a very similar pattern reported for college enrollment

and timing of enrollment. Dual enrollment students who enrolled in a four-year institution completed on average 2.18 more credits in AY 2010-11, or their junior year, than students who enrolled in a two-year institution.

Dual enrollment students who earned a lower GPA were more likely to enroll in a two-year institution than in a four-year institution and more than the overall sample. In particular, of the DE students who earned a GPA of 3.00 or higher, 69% enrolled in a four-year institution compared to 31% who enrolled in a two-year institution. The distribution among DE students who earned a GPA less than 3.00 was a little more evenly distributed with 47% enrolling in at two-year institution compared to 53% enrolling in a four-year. Students who enrolled in a four-year institution earned 0.29 higher GPA on average than their two-year institution counterparts.

The data on community college award and institutional type follow a pattern one might expect. Certificate and associate degree earners enrolled in four-year institutions at significantly higher rates (89%) than two-year institutions and the overall sample (65%), $\chi^2(4, n = 16{,}019) = 106.375$, $p < .001$, and Cramer's V = .081. Given that these DE students already completed a two-year credential, it is not surprising that they would enroll in a four-year institution as the next step in their postsecondary educational pathways. Students who earned a CSC were more likely, however, to enroll in a two-year institution. Again, this pattern is fairly reasonable given that the CSC is a program pathway designed to help prepare students for certificate, diploma, and degree programs that lead to gainful employment.

Table 36

Crosstabulation of Institutional Type and Community College Award

Institutional Type	Community College Award				
	Career Studies Certificate	Certificate	Certificate + Degree	Degree	No Award
Enrolled in 2-year	46 (59.7%) (4.5)	14 (38.9%) (0.4)	9 (7.8%) (-6.2)	6 (5.1%) (-6.9)	5593 (35.7%) (5.4)
Enrolled in 4-year	31 (40.3%) (-4.5)	22 (61.1%) (-0.4)	106 (92.2%) (6.2)	112 (94.9%) (6.9)	10080 (64.3%) (-5.4)

Note. Adjusted residuals appear in parentheses below observed frequencies

Dual enrollment students who completed 12 or more DE credits and more college transfer credits, as well as earned a higher GPA and certificate and/or associate degree enrolled in four-year institutions at higher rates than two-year institutions and the overall sample. Given the nature of college transfer credits and community college awards earned, these enrollment patterns are not too surprising. The data do seem to indicate, however, a differentiation in the type of DE students who enroll in college, immediately enroll, and enroll in a four-year institution. In the next section, I explore this line of thinking with the presentation of a logistic regression that incorporates all of the student demographic and academic metrics variables.

Research Question 3: Predicting Enrollment in College

The third and final research question explored the predictive value of student demographics and academic metrics on a Virginia DE student's non-enrollment in postsecondary education after high school graduation:

3. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of non-enrollment?
    a. Do identified student demographics and/or academic metrics of high school dual enrollment students predict the rate of delayed enrollment?
    b. Do identified school-level characteristics predict the rate of non-enrollment?

A binomial logistic regression was performed to build the predictive model and answer this research question. The logistic regression was statistically significant, $\chi^2(21) = 1616.196$, $p < .001$. According to Nagelkerke R^2, 14.7% of the variance in college enrollment was explained by the model, indicating a rather weak predictive model.

The baseline model, prior to any independent variables being added to the model, indicated that 84.8% of DE students would be classified correctly assuming all students enrolled in college. After performing the logistic regression, the model only modestly improved by 0.2 percentage points to correctly classify 85.0% of DE students overall.

Four other measures of accuracy of the model are sensitivity, specificity, positive predictive value, and negative predictive value (Laerd Statistics, 2015). Sensitivity reflects the percentage of students that actually enrolled in college and were correctly predicted by the model as enrolled in college. Sensitivity was 99.1% in the model. Specificity is the percentage of students that did not enroll in college and were correctly predicted by the model as not enrolled in college. Specificity was 6.1%. Sensitivity and specificity are measures of true positives, if you will. The positive predictive value was 85.4%, which reflects the percentage of correctly predicted students who enrolled in college compared to the total number of students predicted as enrolled in college. The

negative predictive value reflects the percentage of correctly predicted students who did not enroll in college compared to the total number of students predicted as not enrolled in college, and was 56.3%. These measures indicate the difficulty for the model to predict that a student would not enroll in college.

Table 37

Percentage Accuracy in Classification of Enrollment in College for Virginia DE Students

		Predicted		
		College Enrollment		Percentage
Observed		Did Not Enroll	Enrolled	Correct
College Enrollment	Did Not Enroll	171	2,617	6.1
	Enrolled	133	15,363	99.1
Overall Percentage				85.0

Note. The cut value is .500

As presented in Table 38, the odds ratios for each independent variable indicate the likelihood of a DE student enrolling in college for each one-unit increase of that particular independent variable (Laerd Statistics, 2015). For nominal variables, the odds ratios are compared against the reference category listed in parentheses in the table. For example, the logistic regression results indicate that female DE students are 1.6 times as likely to enroll in college as male DE students. First generation DE students are almost half as likely to enroll in college as their non-first generation counterparts. Dual enrollment students who first enrolled in DE as high school seniors are 9.5 times as likely to enroll in college as DE students who first enrolled as high school freshmen. Community college award earners are less likely to enroll in college than DE students who did not earn a community college award before graduating from high school, according to the predictive model but in contrast to what the data actually demonstrated in the research. Although race/ethnicity was statistically significant overall (p = .006),

African American was the only statistically significant race/ethnicity category (p = .005), which indicates that African American DE students are 1.2 times as likely to enroll in college as White DE students.

Table 38

Summary of Logistic Regression Analysis for Student Demographics and Academic Metrics Variables Predicting Enrollment in College

Variable	B	Wald	*p*	Odds Ratios
Gender				
Female(1)	0.494	0.044	0.000	1.639
(reference = Male)				
Age in first DE course	-0.438	0.040	0.000	0.645
First Generation				
Yes(1)	-0.583	0.053	0.000	0.558
(reference = No)				
Free and reduced-price lunch	-0.017	0.002	0.000	0.983
Total terms enrolled in DE	0.182	0.031	0.000	1.200
First term enrolled in DE		296.933	0.000	
Sophomore(1)	0.606	0.117	0.000	1.834
Junior(2)	1.382	0.123	0.000	3.983
Senior(3)	2.251	0.150	0.000	9.499
(reference = Freshman)				
GPA	0.405	0.027	0.000	1.500
Total DE credits attempted	-0.042	0.013	0.001	0.959
Total DE credits completed	0.076	0.013	0.000	1.079
Award		50.749	0.000	
Certificate + Degree(1)	-1.871	0.377	0.000	0.154
Career Studies Certificate(2)	-1.243	0.247	0.000	0.289
Certificate(3)	-1.257	0.491	0.010	0.284
Degree(4)	-0.892	0.427	0.037	0.410
(reference = No Award)				
Race/Ethnicity		18.059	0.006	
Not Specified(1)	0.155	0.112	0.166	1.168
Hawaiian/Pacific Islander(2)	0.051	0.467	0.913	1.052
African American(3)	0.179	0.064	0.005	1.196
Hispanic(4)	-0.177	0.095	0.063	0.838
Asian(5)	0.029	0.126	0.814	0.971
American Indian/Alaskan(6)	-0.509	0.284	0.073	0.601
(reference = White)				
Constant	5.860	0.581	0.000	332.198

Note. The dependent variable in this analysis is college enrollment so that 0 = did not enroll in college and 1 = enrolled in college.

Looking at the odds ratios for continuous variables, students from families with lower income (as measured by higher percentages of the student population receiving free and reduced-price lunch at DE students' high schools) are less likely to enroll in college, as are students who attempt more DE credits. However, DE students who complete more DE credits are more likely to enroll in college, as are students who enroll in more terms and earn higher GPAs.

The results of the logistic regression analysis of variables predicting college enrollment of DE students are not surprising and follow similar college enrollment patterns of overall student populations, with the exception of African American DE students enrolling at higher rates than White DE students. This data point suggests African American students to benefit more from DE in terms of college enrollment outcomes. Comparisons between college enrollers and non-college enrollers are discussed in the next chapter. The overall model was fairly weak, though, indicating that predictions of which DE students would enroll and which would not enroll in college by student demographics and academic metrics were not very good.

Predicting timing of college enrollment. A second part of this analysis was conducted to investigate the timing of college enrollment: immediate (i.e., enrolled by fall 2012) and delayed (i.e., enrolled by fall 2013, 2014, or 2015). Again, a binomial logistic regression was performed. The model was found to be statistically significant, $\chi^2(21) = 595.497$, $p < .001$, and explained 7.5% of the variance in the timing of college enrollment, according to Nagelkerke R^2. The results are presented in Tables 39 and 40.

Similar to the results for enrollment in college, the baseline model indicated that 89% of DE students would be classified correctly if it were assumed that all students

immediately enrolled in college. However, after adding the independent variables to the model this percentage remained the same. As seen in Table 39, only a few DE students (n = 8) who delayed enrollment would be correctly classified as delaying enrollment.

Table 39

Percentage Accuracy in Classification of Timing of College Enrollment for Virginia DE Students

		Predicted		
		Timing of Enrollment		Percentage
Observed		Immediate	Delayed	Correct
Timing of	Immediate	13,777	8	99.9
Enrollment	Delayed	1,702	8	0.5
Overall Percentage				89.0

Note. The cut value is .500

For timing of college enrollment, sensitivity was 99.9%, indicating the percentage of students that immediately enrolled and were correctly predicted to enroll immediately sensitivity was 0.5%. Specificity reflects the percentage of students that delayed enrollment in college and were correctly predicted by the model as delaying enrollment. The percentage of correctly predicted students who delayed enrollment in college compared to the total number of students predicted as delaying enrollment, or the positive predictive value, was 0.5%. The negative predictive value, which reflects the percentage of correctly predicted students who immediately enrolled in college compared to the total number of students predicted as immediately enrolling, was 89.0%. Once again, these measures indicate a challenge in predicting the timing of enrollment of DE students based on this model.

As with enrollment in college, the odds ratios reported in Table 40 indicate the likelihood of a DE student delaying enrollment for each one-unit increase for each independent variable (Laerd Statistics, 2015). Again, the reference group for which

nominal variables are compared against is included in parentheses in the table. Using this logic, the odds ratios indicate that female DE students are less likely to delay enrollment in college than male DE students, and therefore, are more likely to immediately enroll. Dual enrollment students who are first generation are 1.5 times as likely to delay enrollment as those who are not first generation college students. When students first enroll in DE as high school juniors, they are 1.5 times more likely to immediately enroll than students who first enrolled as high school freshmen. Dual enrollment students who graduate high school with a community college award are more likely to delay enrollment in college than DE students who do not earn an award, as shown in the predictive model. Career Studies Certificate earners are 3.5 times as likely, Certificate earners are 2.2 times as likely, Degree earners are 1.8 times as likely, and Certificate plus Degree earners are 1.7 times as likely to delay enrollment in college as DE students who did not earn an award. Similar to enrollment in college, race/ethnicity was statistically significant overall (p = .001), and African American was statistically significant (p = .001). In contrast to enrollment in college, however, was the Hispanic race/ethnicity category that was also statistically significant (p = .001). African American DE students were 1.3 times and Hispanic DE students were 1.8 times more likely to delay enrollment in college than White DE students.

The free and reduced-price lunch variable was used as a proxy for family income. The odds ratios indicate that students from high schools with higher percentages of students receiving free and reduced-price lunch and therefore, families with lower income, are more likely to delay enrollment. Academic metrics variables also indicate

that DE students who enrolled in DE for more terms, earned higher GPAs, and completed more DE credits are less likely to delay enrollment in college.

Table 40

Summary of Logistic Regression Analysis for Student Demographics and Academic Metrics Variables Predicting Timing of Enrollment

Variable	B	Wald	*p*	Odds Ratios
Gender				
Female(1) (reference = Male)	-0.183	11.861	0.001	0.833
Age in first DE course	-0.108	4.394	0.036	0.898
First Generation				
Yes(1) (reference = No)	0.413	37.37	0.000	1.511
Free and reduced-price lunch	0.008	18.234	0.000	1.008
Total terms enrolled in DE	-0.091	5.925	0.015	0.913
First term enrolled in DE		12.567	0.006	
Sophomore(1)	-0.202	1.799	0.180	0.817
Junior(2)	-0.412	6.708	0.010	0.662
Senior(3) (reference = Freshman)	-0.290	2.241	0.134	0.748
GPA	-0.420	159.044	0.000	0.657
Total DE credits attempted	0.046	8.429	0.004	1.047
Total DE credits completed	-0.072	19.365	0.000	0.931
Award		20.268	0.000	
Certificate + Degree(1)	0.558	1.022	0.312	1.747
Career Studies Certificate(2)	1.260	17.73	0.000	3.525
Certificate(3)	0.804	1.616	0.204	2.234
Degree(4) (reference = No Award)	0.586	1.650	0.199	1.797
Race/Ethnicity		42.826	0.000	
Not Specified(1)	0.135	1.212	0.271	1.145
Hawaiian/Pacific Islander(2)	-1.387	1.841	0.175	0.25
African American(3)	0.239	10.565	0.001	1.270
Hispanic(4)	0.592	31.344	0.000	1.808
Asian(5)	-0.088	0.297	0.586	0.916
American Indian/Alaskan(6) (reference = White)	-0.764	1.617	0.204	0.466
Constant	1.417	0.753	0.060	4.125

Note. The dependent variable in this analysis is timing of college enrollment so that 0 = immediate enrollment and 1 = delayed enrollment.

The regression model for predicting whether DE students would immediately enroll or delay enrollment in college followed a similar pattern as the previous regression for predicting college enrollment. Students from less diverse populations (e.g., non-minority, non-first generation, higher family income, etc.) are more likely to immediately enroll in college. Although the model's ability to predict the timing of college enrollment was weak, understanding who will delay enrollment in college has important implications for moving the needle in college completion with previous research demonstrating delayed enrollment as a risk factor (Bozick & DeLuca, 2005).

Predicting college enrollment with multi-level analysis. A third part of this analysis introduced additional variables to consider the potential contribution of individual and school-level variables and provide understanding of the ways in which school context may influence a student's decision to enroll in college. A multi-level analysis was conducted using four school-level variables and two academic metric variables to take into account the hierarchical structure or arrangement of students in their respective high schools (Albright & Marinova, 2010). Both individual and school-level characteristics were explored through multi-level analysis.

The school-level variables included high school type (e.g., public, private), size of high school (number of students enrolled in high school), locale of high school (e.g., urban, suburban, rural, and town), and percentage of students receiving free and reduced-price lunch (used previously as a proxy for family income but now being utilized as a school-level characteristic). Fall membership data were used for high school enrollment data from Virginia DOE for public high schools. Total students data was used for high school enrollment data from NCES for private high schools. Similarly, these data

sources provided the locale of the high school again for public and private high schools, indicating the high school's proximity to populous areas.

Two new academic metric variables were created from existing variables. A success variable was created using total number of DE credits completed divided by total number of DE credits attempted to reflect an overall success rate for each DE student. An intensity variable was created using total number of DE credits attempted divided by the maximum number of total DE credits attempted per high school to reflect a rate of the intensity of coursework compared to other DE students at respective high schools. The maximum number of total DE credits for the school is used as a proxy for the number of DE courses available since there is no formal tracking of DE courses that are available at each school.

To test whether multi-level modeling was necessary, a null model, which did not include any predictor variables, was run. The results of the null model indicated a significant second-level intercept ($\gamma_{00} = 1.91$, $p < .001$), which demonstrated multi-level modeling was warranted. Therefore, a second model was run, which included student habitus, or level 1, predictors. The second run compared the level 1 model with the null model and indicated statistical significance, $\chi^2(17) = 1448.070$, $p < .001$, meaning the student habitus predictors help predict whether a DE student will enroll in college after high school graduation. A third model was run with school-level, or level 2, predictors. The third model found even better significance, $\chi^2(4) = 48.957$, $p < .001$, than the first-order model meaning the school-level predictors are also helpful in predicting college enrollment. Therefore, these results indicate multi-level analysis with student habitus

(level 1) and school-level (level 2) variables offers a better way to predict college enrollment. The results of the two-level model are presented in Table 41.

The odds ratios reported in Table 41 indicate the likelihood of a DE student enrolling in college after high school graduation for each one-unit increase in each independent variable (Laerd Statistics, 2015). Similar to previous analyses, the odds ratios indicated that females are 1.6 times as likely to enroll as males and non-first generation college students are twice as likely to enroll as first generation students, as are DE students who first enrolled in DE as high school seniors compared to those who first enrolled as high school freshmen. Dual enrollment students who enroll in more terms of DE while in high school are more likely to enroll in college, as are students who earned higher GPAs. Again, the odds ratios indicated statistical significance for African American DE students being 1.2 times as likely to enroll in college as White DE students.

One difference existed between the predictive model conducted previously and the multi-level analysis. The predictive model indicated that DE students who attempted more credits were less likely to enroll in college. However, in the multi-level analysis total DE credits attempted were not statistically significant, indicating an opportunity for future research to further explore the relationship with DE credits attempted and college enrollment.

Table 41

Summary of Multi-level Analysis for Student Habitus and School-level Variables Predicting Enrollment in College

Effect	Coefficient	Odds Ratio	Standard error	*t*-ratio	Approx. *df*	*p*
For INTRCPT1, β_0						
INTRCPT2, γ_{00}	3.674823	39.441665	0.715191	5.138	299	<0.001
Free and reduced-price lunch, γ_{01}	-0.012837	0.987245	0.002955	-4.345	299	<0.001
High school type, γ_{02}	0.464642	1.591445	0.228577	2.033	299	0.043

Effect	Coefficient	Odds Ratio	Standard error	*t*-ratio	Approx. *df*	*p*
High school locale, γ_{03}	-0.126887	0.880833	0.057145	-2.220	299	0.027
High school enrollment, γ_{04}	0.000189	1.000189	0.000080	2.355	299	0.019
For Gender slope, β_1						
INTRCPT2, γ_{10}	-0.522192	1.593219	0.048705	-10.721	17841	<0.001
For First generation slope, β_2						
INTRCPT2, γ_{20}	-0.552926	0.575264	0.056960	-9.707	17841	<0.001
For Age slope, β_3						
INTRCPT2, γ_{30}	-0.393216	0.674883	0.041821	-9.402	17841	<0.001
For First term enrolled in DE slope, β_4						
INTRCPT2, γ_{40}	0.745464	2.107419	0.049746	14.985	17841	<0.001
For Award slope, β_5						
INTRCPT2, γ_{50}	-1.078382	0.340146	0.213073	-5.061	17841	<0.001
For Total terms enrolled in DE slope, β_6						
INTRCPT2, γ_{60}	0.231681	1.260718	0.026876	8.620	17841	<0.001
For Total DE credits attempted slope, β_7						
INTRCPT2, γ_{70}	-0.023245	0.977023	0.022241	-1.045	17841	0.296
For Total DE credits completed slope, β_8						
INTRCPT2, γ_{80}	0.052517	1.053921	0.023606	2.225	17841	0.026
For GPA slope, β_9						
INTRCPT2, γ_{90}	0.383736	1.467759	0.025923	14.803	17841	<0.001
For Intensity slope, β_{10}						
INTRCPT2, γ_{100}	0.005727	1.005744	0.001664	3.442	17841	<0.001
For Success slope, β_{11}						
INTRCPT2, γ_{110}	0.003543	1.003549	0.003377	1.049	17841	0.294
For Race/Ethnicity Not Specified slope, β_{12}						
INTRCPT2, γ_{120}	0.070048	1.072560	0.117875	0.594	17841	0.552
For African American slope, β_{13}						
INTRCPT2, γ_{130}	0.161700	1.175508	0.078471	2.061	17841	0.039
For Hispanic slope, β_{14}						
INTRCPT2, γ_{140}	-0.391885	0.675782	0.098226	-3.990	17841	<0.001
For Asian slope, β_{15}						
INTRCPT2, γ_{150}	-0.198991	0.819557	0.131996	-1.508	17841	0.132
For American Indian slope, β_{16}						
INTRCPT2, γ_{160}	-0.529617	0.588830	0.294906	-1.796	17841	0.073
For Hawaiian/Pacific Islander slope, β_{17}						
INTRCPT2, γ_{170}	-0.105324	0.900033	0.494320	-0.213	17841	0.831

Note. The dependent variable in this analysis is college enrollment so that 0 = did not enroll in college and 1 = enrolled in college.

Two academic metric variables were added to the multi-level analysis. The success rate variable (i.e., total number of credits completed divided by total number of credits attempted) was not found to be statistically significant. The intensity variable (i.e., total number of credits attempted divided by the maximum number of total credits attempted per high school) was statistically significant, indicating that DE students with a higher rate of intensity are more likely to enroll in college.

All four school-level variables were statistically significant. Although previously, the percentage of students receiving free and reduced-price lunch at DE students' high school was analyzed as a student demographic variable (level 1) as a proxy for family income, in the multi-level analysis, this variable was used as a school-level variable (level 2). Here, as before, the result was statistically significant, indicating that DE students who graduated from high schools with a higher percentage of students receiving free and reduced-price lunch are less likely to enroll in college. Dual enrollment students who graduated from a private high school are 1.6 times more likely to enroll in college as those who graduated from a public high school. The locale of the high school, its proximity to populous areas, indicates that students who graduated from a rural high school are less likely to enroll in college than students who graduated from an urban high school. The size of the high school (i.e., number of students enrolled) was also a predictor of college enrollment with DE students who graduated from high schools with a larger enrollments being more likely to enroll in college than those who graduated from high schools with smaller enrollments.

Multi-level analysis further substantiated the results from the previous analyses with only minor differences between the analyses. The results of multi-level analysis

provided additional predictors of college enrollment (i.e., school-level characteristics) and strengthened the predictors (i.e., student habitus variables) previously analyzed.

Summary

This study was designed to explore the student demographics, academic metrics, and college enrollment of the 2012 cohort of high school graduates who completed at least one DE course offered by a Virginia Community College while in high school. The sample included 18,862 students who met the sample criteria. Although the overall sample varied in terms of student demographics and academic metrics, the majority of DE students were female (53%), White (73%), non-first generation (85%), first enrolled in DE as high school juniors and seniors (85%), enrolled in DE for four or fewer terms (95%), and completed six or more DE credits (78%). Significant differences emerged across nearly every research variable for each of the three dependent variables: enrollment in college, timing of college enrollment (e.g., immediate vs. delayed), and institutional type (e.g., two-year vs. four-year). These differences signified that DE students who enrolled in college, immediately enrolled in college, and enrolled in a two-year institution were different from DE students who did not enroll, delayed enrollment in college, and enrolled in a four-year institution, respectively. Further these differences were supported by the predictive model, although the model was fairly weak. The regression model predicted that DE students who were White, non-first generation, from families with higher income, completed more DE credits and earned higher GPAs are more likely to enroll in college and more likely to immediately enroll in college. Multi-level analysis indicated that DE students who graduated from more affluent high schools (e.g., fewer students receiving free and reduced-price lunch, located in populous areas,

larger high school enrollments, or private) are more likely to enroll in college. Collectively, the results from these three questions describe the prototypical Virginia DE student and his/her postsecondary educational pathway, illuminating the gaps in college enrollment patterns for these students. This research also helps to inform policymakers and educators of the opportunities to build stronger and clearer pathways for more diverse student populations participating in DE, and such opportunities are discussed in the next chapter.

CHAPTER 5: DISCUSSION

The social and economic climate in the United States underscores the demand for and value of a college education (Carnevale et al., 2013; National Skills Coalition, 2014). This influence is evidenced by the fact that college degree holders earn more money than non-degree holders and contribute to their communities in tangible and meaningful ways (Baum et al., 2013). Pointedly, more than half of all jobs now require some education beyond high school, but not necessarily a four-year degree (National Skills Coalition, 2014). Further, public policy supports the perception of who should attend college and influences who actually does attend college through legislation and federal financial aid programs (Fowler, 2009; Hutcheson, 2007; Perna & Titus, 2004). Despite the articulated need for and value of postsecondary education, many high school graduates do not enroll in college.

Community colleges have helped bridge the gap for America's educational and training needs in many ways. Situated between secondary and postsecondary education and business and industry, community colleges are strategically positioned to help build an educated and skilled workforce through a variety of college and career pathways (Amey et al., 2007; Bragg, 2011). With open-access admissions and low-cost tuition, community colleges have historically welcomed a diverse student population, providing postsecondary education opportunities for individuals who might not otherwise pursue higher education (Cohen et al., 2013; Malcom, 2013).

The position of community colleges to assist students and institutions themselves with the transition between secondary and postsecondary education is leveraged by dual enrollment (DE) programs. Community colleges are the primary provider of DE programs with 71% of DE students across the nation participating in a DE program offered by a two-year institution (Marken et al., 2013). In Virginia, 96% of DE students are served by a Virginia Community College (SCHEV, 2015c). The fact that one in 10 students attending a Virginia Community College is a high school student (VCCS, 2015c) further demonstrates the scope of DE partnerships between high schools and community colleges.

Dual enrollment programs provide high school students the opportunity to enroll in college courses while still in high school (Karp & Jeong, 2008). By design, DE promotes college enrollment and completion by giving students the opportunity to try on and perform the role of college student, and earn college credits prior to high school graduation. This opportunity provides a valuable learning experience for these prospective college students, and as such, an opportunity that merits further research on the program's demographic and outcomes—an impetus of this research study.

The current study supports the findings of previous research in demonstrating positive outcomes for students participating in DE. Dual enrollment students are more likely to enroll in college, earn higher grades in high school and in college, and earn a college credential (Allen & Dadgar, 2012; An, 2015; Bailey & Karp, 2003; Carter, 2009; Colorado Department of Higher Education, 2014; Cowan & Goldhaber, 2015; Crouse & Allen, 2014; Hughes et al., 2012; Karp et al., 2007; Pretlow & Wathington, 2014; Taylor, 2015). These programs also help students shorten the timeframe for completing a college

degree and reduce the cost of a college education (Johnson & Brophy, 2006; Westcott, 2009). Further, specific program offerings, such as a structured curriculum and targeted student support services, provide the additional support needed by students from diverse academic and economic backgrounds to help them maximize their success in DE and optimize the benefit of DE programs (Barnett & Stamm, 2010; Hughes et al., 2012). Importantly, the current study indicates that Virginia DE students enroll in college at rates higher than state and national averages.

Given such promising results for participation in DE, one would expect students and institutions to be clamoring to partake in more DE opportunities. Unfortunately, the opportunity for DE to be leveraged as a strategy for preparing students from a variety of academic and economic backgrounds for success in college has largely been ignored in Virginia. My study included a comprehensive examination of who is participating in and benefitting from Virginia DE and found that the vast majority of students enrolling in DE courses mirrored historic norms of the portrait of DE students, namely they are White, have parents who attended college, were academically successful in their classes, and came from families that were not low-income. This study underscores the need for policymakers and educators to better leverage DE programs to prepare a broader range of students for success in college rather than simply providing courses to those students already primed to attend college and succeed (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett & Stamm, 2010; Barnett et al., 2015). The following section outlines the connections of the key findings to suggestions for program expansion.

Summary of Key Findings

The purpose of this study was to explore which student demographics and academic metrics influenced postsecondary educational pathways for high school graduates who participated in DE in Virginia's Community Colleges. Further, this study investigated the predictability of student demographics and academic metrics on student non-enrollment in postsecondary education. Understanding that the structure and context of DE programs contribute to student participation in DE, as well as outcomes pertinent to college enrollment (Hughes et al., 2012), I contextualized DE programs in Virginia using Perna's (2006) college choice framework. Perna's three contextual layers of school and community; higher education; and social, economic, and policy established the context for this study as illustrated in Figure 2. Virginia was selected for the current study because of the high percentage of students participating in DE at a community college, the common policy framework and data elements that offer a more consistent analysis, and the diversity of the Commonwealth's higher education system. Perna's layer of student habitus was selected from the model as the framework for analysis for the collection of student demographics and academic metric variables.

For the current study, student habitus included student demographics (e.g., gender, race/ethnicity, age in first DE course, first generation college indicator, and percentage of high school receiving free and reduced-price lunch) and academic metrics (e.g., first term enrolled in DE, total number of terms enrolled in DE, total DE credits attempted/completed, total DE credits attempted and completed per academic year, total college transfer DE credits attempted and completed, total CTE DE credits attempted and completed, grade point average in DE courses, and award earned from community

college). This study's sample of DE students was more inclusive than in previous studies as this work included all Virginia high school students who graduated in 2012 and took at least one DE course from a Virginia Community College while in high school. These criteria allowed for the inclusion of students who attended public or private high schools (94% and 3% of the sample, respectively) and those who were homeschooled (3% of the sample) in contrast to previous studies that excluded homeschoolers (Cowan & Goldhaber, 2015; Davenport, 2013) and students attending private high school (Cowan & Goldhaber, 2015). The data available for the sample included postsecondary enrollment for two-year and four-year institutions within and outside of Virginia, eliminating the limitation of previous studies in which college enrollment was measured only at in-state institutions (Colorado Department of Higher Education, 2014; Hughes et al., 2012; Karp et al., 2007). By including other high school types and college enrollment in out-of-state institutions, I was able to further explore the postsecondary educational pathways and build a more comprehensive portrait of Virginia DE students that could be used for comparative purposes.

In this study, I found that the majority of DE students enrolled in college after graduating from high school and, overall, DE students who enrolled in college varied significantly from DE students who did not enroll in college across nearly every student demographic and academic metric variable. Similarly, DE students who immediately enrolled in college or enrolled in a two-year institution were statistically significantly different from DE students who delayed enrollment or enrolled in a four-year institution, respectively. Statistical significance, however, was more easily achieved with the large sample size and thus, only some differences were large enough to be considered

meaningful even though the results were statistically significant. Therefore, for the purposes of this chapter, I focus on the differences that have consequential and practical implications. Here, I outline the major findings to illustrate how historic conceptions of the role DE have changed and to suggest ways further leveraging of DE could occur for both students and community colleges.

Different outcomes for Virginia DE students. Based on a traditional measure of success (i.e., college enrollment), Virginia DE is faring well as 85% of DE students enrolled in college after high school graduation compared to only 64% of all Virginia high school graduates who enrolled in college (VDOE, 2015) and 68% of high school graduates across the nation (Bureau of Labor Statistics, 2015). However, hidden beneath this success measure are differential outcomes for students from minority backgrounds, those who were the first in their families to attend college, and those who graduated from high schools with a higher percentage of free and reduced-price lunch participation. Students of color and those in schools with free and reduced-price lunch were more likely to delay college, to attend a community college, or not attend at all. Students from smaller high schools and high schools in rural areas were also less likely to enroll in college after graduating from high school.

Researchers working on the Completion by Design initiative—a project engaging national partners in order to improve college completion rates—cautioned policymakers, leaders, and educators that:

> Looking at student outcomes in a conventional bottom-line way limits a college's ability to peel back the layers of *why* certain favorable or unfavorable results have developed, and what *specific elements* of students' paths from enrollment to

> graduation made the difference between their success and failure (Rassen et al., 2013, p. 7, emphasis in original).

Consequently, the current study was designed in a way that aligns with Completion by Design's notion to "peel back the layers" by disaggregating college enrollment data across student demographics and academic metrics to explore the patterns in the postsecondary education pathways of Virginia DE students. This research approach provided a more comprehensive portrait of Virginia DE than in previous research and highlighted opportunities for policymakers and educators to better leverage DE to address issues of access and success.

A traditional model of DE in Virginia. Traditionally, DE has attracted and served students who were already academically and socially prepared to attend college, and the results from the current study follow a similar pattern. Although, initially DE programs served "high-achieving college-bound" students, providing them the opportunity to get a head start on their college education (Bailey & Karp, 2003, p. vii), more recently the value of these programs has expanded beyond simply offering the opportunity for academically gifted students to earn college credits. Dual enrollment is now seen as a premier opportunity by state policymakers for helping students from a variety of academic and economic backgrounds understand the expectations of being a college student and the rigors of college coursework relative to high school expectations (Kanny, 2015; Karp, 2012). However, the current structure of Virginia DE and the demographic of participants portray a less diverse program in what it offers and who it serves.

Dual enrollment programs are no longer valued as simply a high school enrichment program; rather, they can be leveraged to better prepare high school students for college-level work and for a successful transition to college environments and the role of a college student (Jobs for the Future, 2006; Karp, 2012, 2015). Despite the ability to expand participation in DE courses beyond those that have historically participated in DE (e.g., to include more low-income students or more first-generation college students), the pattern in Virginia remains rooted in tradition. The programmatic structure of DE has evolved to better serve the needs of an increasingly diverse student body, such as providing a structured curriculum and targeted students services to maximize students' success in these programs (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett & Stamm, 2010; Barnett et al., 2015). The pressure to increase the number of educated and skilled workers across the state and nation demands a change in how DE operates in Virginia in order to better attract and retain through completion students from a broad range of academic and economic backgrounds.

Summary. The findings from this research highlight bifurcated outcomes for students participating in DE in Virginia. High achieving, middle class students are going to college, in particular four-year colleges, at higher rates relative to their lower income peers. Those who delay entry into college are more often students of color, first-generation college students, and from families with lower incomes. This latter group more often attends a community college versus a four-year university. First-generation college students and low-income students enroll more frequently in community colleges compared to their peers (USDOE, NCES, 2015c). Likewise, community colleges enroll the highest percentages of students of color in the nation (USDOE, NCES, 2015b). The

historical trend of a more diverse student body enrolling in community colleges substantiates the position of these two-year institutions in providing programs to ensure students are academically and socially prepared for the college environment. Further, the increasing diversity of the student body in higher education today requires that programs, such as DE, are designed and delivered to meet the needs of diverse students (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett & Stamm, 2010; Barnett et al., 2015). The findings from this current research are discussed in the following section.

Discussion

The findings of this research study focus on creating of a portrait of DE students in Virginia and the influence of habitus factors on college-going behaviors. First, I discuss a comparison of the findings of the current study with research conducted in other states, as well as in Virginia. Next, I present a comparison of DE programs in different states to provide expanded context for this study's findings. Finally, I discuss how the portrait of DE students in Virginia ties to the policy intentions of Virginia's DE plan and provide a review of the differences in academic metrics among different student populations. I also discuss the dual pathway of transfer and CTE in Virginia DE.

Outcomes of Virginia DE compared to other states and previous studies. The current study's results indicated that Virginia DE students were more likely to enroll in college after graduating from high school, and were more likely to immediately enroll and enroll in a four-year institution. Overall, these results are similar to previous statewide studies on DE in Colorado (Colorado Department of Higher Education, 2014), Florida (Karp et al., 2007), Illinois (Taylor, 2013), New York (Karp et al., 2007), and Washington (Cowan & Goldhaber, 2015). In terms of college enrollment, Virginia DE is

on par with DE in these states and exceeds overall college enrollment rates within Virginia and across the nation as stated previously.

Although the results from the current and previous studies offer some comparative measures, differences in research design and availability of data did limit my ability to make some comparisons. For example, in a study of Washington State's DE program, Running Start, Cowan and Goldhaber (2015) found that DE students were more likely to enroll in college and immediately enroll in college, much like Virginia DE students. Students in Washington, however, were more likely to enroll in a two-year rather than a four-year institution, a contrast to the data here in Virginia, which demonstrated higher enrollments in four-year institutions. Unfortunately, Cowan and Goldhaber's research did not include any analysis of student subgroups, precluding their ability to focus on any particular student group or their enrollment patterns and making it difficult to draw more conclusive comparisons.

Given that Running Start participants take courses "tuition-free" at any of the state's community colleges (Cowan & Goldhaber, 2015, p. 432), I suspect a different demographic enrolled in Washington's DE program than here in Virginia. Further, Cowan and Goldhaber found that some DE students either did not graduate from high school or earned a GED, which might contribute to higher enrollments of Washington DE students in two-year institutions. Another difference between these statewide DE programs might be that Virginia DE is utilized by students for transfer to four-year institutions more so than in Washington, a likely result of Virginia's transfer agreements between Virginia's Community Colleges and more than 30 public and private four-year institutions (VCCS, 2017b). Yet, without a deeper analysis of student level data, one can

only speculate which Washington DE students are pursuing which postsecondary educational pathways, posing a limitation in drawing parallels to the current study. The absence of student level data and enrollment patterns also makes it difficult for policymakers and educators to make data-driven decisions about how they design and deliver DE programs in Washington to better serve their students, an objective of this study.

Research on Florida's DE provided Karp et al. (2007) the opportunity to examine differential outcomes across diverse student groups. Data showed male and low-income students to benefit from Florida's DE at greater rates than their non-DE counterparts, in particular in CTE. A comparison between Virginia and Florida shows differences in the college enrollment rates of CTE students, specifically Florida's CTE students enroll in college at greater rates than Virginia's CTE students. The pathway into CTE programs in Florida's community colleges may provide more options relative to those available in Virginia. As well, it may be that high school counselors provide differential advising to CTE students in Florida relative to Virginia. The current study describes the demographics of Virginia CTE students, which can help inform administrators and educators where to focus strategies for improving the college and career pathways of these students.

In Taylor's (2013) study on Illinois' DE program, he explored the average effect of participation in DE on college enrollment and college completion, and then further analyzed the average effect for low-income students and minority students. Overall, Illinois' DE had a positive effect on students' enrollment and success in college when compared to non-DE students (Taylor, 2013). However, similar to Virginia, these effects

were not as large for low-income or minority students, and thus, revealed differential outcomes for the state's DE program. These results also exposed the need for stronger policy language to leverage DE as a mechanism in Illinois for helping diverse student populations enroll and succeed in college, an opportunity that emerged for Virginia in the current research. Specific policy recommendations for Virginia are identified later in this chapter. The availability of the current study's analysis provides a baseline for Virginia DE on which some comparisons to other statewide DE programs can be made, allowing policymakers and educators to better design these programs to maximize student outcomes.

Previous studies on Virginia DE do not lend themselves to making comparisons across student groups, however, comparisons can be made with college enrollment rates overall and the timing of enrollment. College enrollment rates have been fairly steady overtime (Table 42), but the timing of enrollment has changed over the 2004, 2006, and 2012 cohorts. Overall, immediate enrollment in college has improved and delayed enrollment has declined.

Table 42

Summary of Timing of College Enrollment of Virginia DE Students from Previous Studies

	Davenport (2013)	Pretlow (2014)		Current Study
Timing of enrollment	2006 cohort	2004 cohort	2006 cohort	2012 cohort
Immediate	64%	54%	58%	75%
Delayed	n/a	33%	28%	10%

Note. Delayed enrollment was measured for four years after high school graduation in Pretlow (2014) and three years after high school graduation for the current study.

Some of the change in the immediate college enrollment rates might be explained by differences in study design between previous studies and the current study. For example, although Davenport (2013) and Pretlow and Wathington (2014) studied similar

2006 cohorts of Virginia DE students, variations in the sample criteria are likely the reason for differences in the rate of immediate college enrollment. Similarly, the DE sample for the current study was more inclusive than previous studies (i.e., included students who were homeschooled and those who attended private high schools), which could attribute to some of the difference in college enrollment since homeschoolers and private high school students were more likely to enroll in college (see Chapter 3).

It is also likely that the improved rate of immediate college enrollment of Virginia DE students can be attributed to shifts in policy structures in Virginia higher education—namely tuition and transfer agreements (factors in Layers 3 and 4 of Perna's model). The average cost of tuition at a Virginia four-year institution in 2008-09 was $4,761. By 2011-12, the average cost of tuition four-year college tuition had increased to $6,224, for a total increase of $1,463 or 31% (SCHEV, 2017b). During the same timeframe, Virginia's Community Colleges maintained tuition at one-third the cost of the average four-year (SCHEV, 2017b), providing DE students an affordable opportunity to earn college credits at a much lower cost than they would at a four-year institution after high school. Further, with system-wide guaranteed admission/transfer agreements between the VCCS and more than 30 public and private institutions of higher education in Virginia (VCCS, 2017b), it is likely that upon completing some college credits in high school, Virginia DE students were then able to continue their postsecondary educational pathways more easily than in previous years. The majority of these transfer agreements have been established and/or updated in the last 10 years to provide better transfer arrangements for community college students interested in pursuing a four-year degree. The rising cost of a college education and the opportunity for a smoother transfer to a

four-year institution are two highly probable explanations for the increase in immediate college enrollment of Virginia DE students.

It is also important to note that although the overall college enrollment rate appears to have slightly declined in Virginia between 2004 (87%), 2006 (86%), and 2012 (85%), Pretlow and Wathington's (2014) research measured college enrollment for four years after high school graduation, one additional year beyond the measure of college enrollment for the current study. It is reasonable then to assume that 1% to 2% more students will enroll in college in the fourth year following high school graduation, a measure that was too early to collect for the current study.

Pretlow and Wathington (2014) found that DE students in the 2004 and 2006 cohorts who delayed enrollment were more likely to enroll in a two-year institution (i.e., Virginia Community College) than a four-year institution. Students in the 2012 cohort from the current study who delayed enrollment in college were also more likely to enroll in a two-year institution compared to four-year institutions (Table 42). This enrollment trend for delayed enrollers is a little surprising because it suggests a potential leak in the pipeline for Virginia's Community Colleges. Dual enrollment students are considered both high school students and college students, and specifically community college students for Virginia DE. When a DE student does not enroll even in community college the semester following high school graduation, it arguably suggests an issue of retention rather than college enrollment. There were 718 students, or 4% of the sample, who were enrolled in DE in spring 2012 and delayed enrollment in college, namely a two-year institution, until a later semester. From the sample data, it could not be ascertained whether students who delayed enrollment and eventually enrolled in a two-year

institution enrolled at the same institution where they had participated in DE, but it does beg the further exploration of the reasons for delaying enrollment in college particularly when research suggests lower completion rates for delayed enrollers (Adelman, 2006; Bozick & DeLuca, 2005).

With the current study, a more comprehensive view of Virginia DE students demonstrates which students are enrolling in college, as well as which students enrolled immediately after high school graduation or delayed enrollment and enrolled in either two-year or four-year institutions. Like the other studies highlighted above, the overall patterns of DE participation and college enrollment are fairly similar, with the exception of CTE students. Empirically, the results of this current study indicate which students could benefit most from DE opportunities in Virginia and how policy can support a wider band of participation in DE programming, valuable information that has not been available in previous studies on DE.

Model of Virginia DE compared to other DE models. As has been discussed throughout this research, there are several program models for helping students access and succeed in postsecondary education (see Table 1). Dual enrollment is one such model and variations exist even among these programs. The extant literature on statewide DE programs illustrates variations in program design and implementation, which has the potential to influence participant demographics and program outcomes. Given these programmatic differences, it can be difficult to establish appropriate comparisons between DE programs. However, the existing and current research is relatively clear overall in finding that DE has a positive effect on participants. In Table 43, I summarize the programmatic structure of several state DE programs, those delivered

primarily by community colleges, which provides a basis for comparison to Virginia DE. The comparative state programs were selected based on the DE research conducted in these states and highlighted previously in the current study.

Based on their review of the literature, Bailey and Karp (2003) developed a typology of credit-based transition programs—those that allow high school students to take and earn college credit and therefore, include various models of DE—in terms of their "intensity and ability to expose students to a wide range of 'college-like' experiences" (p. viii). Their typology included three broad categories, and DE programs were classified under each of the three typologies, indicating that these programs can be designed and implemented to provide a range of services and supports to a broad audience of high school students:

- *Singleton programs* enrich the high school curriculum and help students get a head start on their college education by offering advanced coursework that students elect to take.
- *Comprehensive programs* provide more structure around course offerings for students, requiring a greater participatory commitment in terms of the number of courses taken; yet like singleton programs, focus primarily on providing a more academically rigorous curriculum in high school.
- *Enhanced comprehensive programs* provide a concentrated pre-college experience with a structured curriculum and multiple supports, such as advising and mentoring.

According to Bailey and Karp's (2003) typology, Virginia DE would be currently classified as a singleton typology, as are the Florida and Illinois DE programs. Based on

the availability of additional support services and structured curriculum, other state DE programs (e.g., CUNY, North Carolina, and Washington) would be considered comprehensive and enhanced comprehensive programs. These latter programs provide the needed structure and support for underserved students who often need additional levels of support for success in college (Barnett & Stamm, 2010; Hughes et al., 2012).

The program objective influences how DE programs are designed and delivered, and the intended audience. Some DE programs are designed with the expressed purpose to expand participation in DE to students from a variety of academic and economic backgrounds. For example, CUNY's College Now program "was designed specifically to serve students who might not otherwise be able to attend postsecondary institutions and who receive inadequate college preparation in the city's high schools" (Hoffman, Vargas, & Santos, 2009, p. 51). Likewise, North Carolina's Learn and Earn program targets students who may not be high-achieving or traditionally college-bound (Hoffman et al., 2009). However, in Virginia, the purpose for DE remains as an opportunity to allow high school students to earn college credits with little to no expressed intent to broaden access to postsecondary education, serve traditionally underserved students, and/or smooth the transition from high school to college.

The policy governing Virginia DE is also less restrictive on student eligibility than some states' DE policies. For example, Florida DE has GPA requirements in addition to college placement exam scores (Hoffman et al., 2009), whereas Virginia currently does not have a GPA requirement, but does require college readiness as

Table 43

Summary of DE Models Provided Primarily by Community Colleges for Comparison to Virginia DE Model

Program Description	Typology	Program Objective	Student Eligibility	Literature
Virginia Dual Enrollment	Singleton	Provide a wider range of course options for high school students in academic, career/ occupational-technical subject areas, promote rigorous educational pursuits, and encourage learning as a lifelong process	High school juniors and seniors (freshmen and sophomores with approval) placed in college-level coursework	Pretlow (2014); Pretlow & Wathington (2013, 2014)
CUNY College Now Dual Enrollment	Enhanced Comprehensive	Help students meet high school graduation requirements and prepare for success in college, both academically and socially; reduce the need for remediation in college	Students who might not otherwise be able to attend college	Hoffman et al. (2009); Karp et al. (2007)
Florida Dual Enrollment	Singleton	Provides a seamless transition between secondary and postsecondary education, allowing students to earn both high school and college credit for dual enrollment coursework.	Students pursuing general education must have a 3.0 GPA and students pursuing a career certificate must have a 2.0 GPA; placement in college-level coursework to receive financial support.	CCRC (2012); Karp et al. (2007)
Illinois Dual Credit	Singleton	Offer opportunities for improving degree attainment for underserved student populations	Varies, but frequently: college admission standards or placement scores, high school recommendation, guidance; high school GPA; junior or senior status; age	Taylor (2013, 2015)
North Carolina Learn and Earn Dual Enrollment	Enhanced Comprehensive	Provide supplemental educational opportunities, particularly for students from rural communities Prepare students for high-skills jobs by encouraging them to complete some college before high school graduation	Students are reflective of local school district populations, and Learn and Earn targets students not normally found on a college path	Hoffman et al. (2009)
Washington Running Start Dual Enrollment	Comprehensive	Provide tuition-free courses at state's community colleges, allowing students to enroll full-time in college during last two years of high school	High school juniors and seniors placed in college-level coursework	Cowan & Goldhaber (2015)

Note. The literature cited includes sources used in the current study, excluding doctoral dissertations.

assessed by placement exams (VCCS, 2008). Although more restrictive student eligibility requirements are expected to limit the diversity of students participating in DE (Pretlow, 2014), in the current study, the data show that even with fewer student eligibility criteria, Virginia's current DE program does not attract as diverse a student body as Virginia's Community Colleges or other Virginia institutions of higher education.

Another difference among statewide DE programs surfaced around CTE students and specifically, their college enrollment patterns. In Florida, DE students were classified as CTE when students took "three courses in the same specific labor market preparation area while in high school" (Karp et al., 2007, p. 23). Florida CTE students were more likely to enroll in college than Virginia students who took CTE credits in DE. The difference in college enrollment between Florida and Virginia CTE students may be influenced by variations in the purpose and structure of CTE in each state and highlights the opportunity for future research that could lead to better program outcomes for CTE students in Virginia DE.

With lower participation rates of underserved student populations across all the studies, the opportunity exists to expand program participation and better serve these student populations in DE programs overall—particularly, as these students are most likely to benefit the most from early college experiences and targeted support services. The current DE model of DE in Virginia, then, portrays a fairly traditional model that has simply moved the start line for college into high school, rather than creating a model designed and implemented to align with the needs of Virginia students most likely to benefit from early college experiences. The traditional model and structure of Virginia

DE constrains broad-based student participation in DE. For the 2012 cohort, DE provided college credits to students already planning on college. The DE program did not provide increased opportunity for college pathways and had limited post-secondary options for CTE students. Borrowing from the practices in other states, Virginia could build better pathways for CTE students and offer a more comprehensive program of support to expand the college-going pipeline.

Portrait of Virginia DE. Virginia's Community Colleges have been providing DE opportunities to high school students since the adoption of the *Virginia Plan for Dual Enrollment* in 1988 (VCCS, 1988). According to the Virginia Plan, a leading purpose for Virginia DE is to promote college enrollment by allowing high school students to complete college credits. Although this purpose is not explicitly stated in the first three iterations of the Virginia Plan, it is expressed in the ideal that "high school students who accrue college credit are more likely to continue with their education beyond high school than those who do not" (VCCS, 1988, 2005, 2008, p. 1). However, promoting college enrollment as a purpose of DE is overly general and neglects the opportunity to leverage DE as a strategy for assisting students to access and succeed in postsecondary education. Consequently, the absence of a clearly articulated purpose or goal for Virginia DE yields a demographic of DE students that is less diverse than Virginia's Community Colleges, higher education in Virginia, and higher education across the nation. Although DE is valued as a premier opportunity for preparing students from a broad range of academic and economic backgrounds for a variety of college and career pathways, currently Virginia DE is largely reaching only a select group of students—students who are non-minority and most likely already college-bound.

Student demographics and college enrollment. Although Virginia DE can boast high college enrollment rates, the nuances of Virginia DE students' rates of college enrollment surfaced when I looked across each student demographic and academic metric variable. The data showed lower college enrollment rates and a greater propensity for delaying enrollment in college for African Americans, Hispanics, first generation college students, and students from lower income families. Table 44 summarizes the data analysis in a way that reveals the disparity in college enrollment across each variable of student habitus. The percentage of each demographic (e.g., race/ethnicity, first generation college status, etc.) can be compared across the total sample of DE students, those who enrolled in college, those who immediately enrolled in college, and those who enrolled in a four-year institution. In the following three sections, I use key data points from the current study to illustrate the concern that a traditional model of DE in Virginia is not changing the game for all students, particularly those who could benefit most from early college experiences.

The majority of Virginia DE students enrolled in college (85%), a positive indication of the value of DE in Virginia. Overall the college enrollment patterns of Virginia DE students mirror the patterns of state and national college enrollment for the general population, yet are actually higher, as reported in Table 45. Whereas 85% of Virginia DE students enroll in college, only 64% of Virginia high school graduates (VDOE, 2015) and nationally, 68% of high school students (Bureau of Labor Statistics, 2015) enrolled in college. The demographic of Virginia DE, however, is not as diverse as overall student populations enrolled at Virginia's Community Colleges, at other Virginia

Table 44

Summary of Findings for Student Demographics, Academic Metrics, and College Enrollment of Virginia DE Students

Independent Variables	Total	Dependent Variables: Enrollment in College		Dependent Variables: Timing of Enrollment		Dependent Variables: Institutional Type	
		Enrolled	Did Not Enroll	Immediate	Delayed	2-year	4-year
	N = 18,862	*n* = 16,019	*n* = 2,843	*n* = 14,204	*n* = 1,815	*n* = 5,668	*n* = 10,351
Total	100.00	84.93	15.07	88.67	11.33	35.38	64.62
Gender							
Female	52.69	54.89	40.27	55.46	50.41	52.81	56.03
Male	47.31	45.11	59.73	44.54	49.59	47.19	43.97
Race/Ethnicity							
African American	13.71	13.23	16.43	12.57	18.40	12.86	13.43
American Indian/Alaskan	0.41	0.36	0.67	0.39	0.17	0.37	0.36
Asian	3.22	3.26	2.99	3.35	2.53	1.94	3.98
Hawaiian/Pacific Islander	0.21	0.21	0.21	0.23	0.06	0.26	0.18
Hispanic	4.65	4.41	6.01	4.01	7.49	5.65	3.73
White	73.29	73.93	69.68	74.94	66.06	74.84	73.43
Not Specified	4.51	4.60	4.01	4.51	5.29	4.08	4.89
Age in first DE course							
< 18 years old	94.50	95.14	90.93	95.52	92.18	92.96	96.33
> 18 years old	5.50	4.86	9.07	4.48	7.82	7.04	3.67
First Generation							
Yes	15.32	13.72	24.31	13.00	19.39	20.36	10.09
No	84.68	86.28	75.69	77.15	80.61	79.64	89.91
Free/reduced-price lunch							
< 25 %	25.68	27.12	17.59	27.70	22.53	18.93	31.60
25-49%	48.20	47.87	50.02	48.13	45.84	49.79	46.83
50-74%	22.79	21.45	30.36	20.93	25.51	26.01	18.95
> 75%	0.26	0.29	0.11	0.28	0.33	0.19	0.34
NA (homeschooled)	3.07	3.27	1.93	2.95	5.79	5.08	2.28

Independent Variables	Total *N* = 18,862	Dependent Variables Enrollment in College Enrolled *n* = 16,019	 Did Not Enroll *n* = 2,843	Timing of Enrollment Immediate *n* = 14,204	 Delayed *n* = 1,815	Institutional Type 2-year *n* = 5,668	 4-year *n* = 10,351
First term enrolled in DE							
Freshman	4.52	4.11	6.86	3.91	5.67	4.20	4.06
Sophomore	10.36	9.94	12.73	9.96	9.81	9.97	9.93
Junior	41.12	41.07	41.40	41.80	35.37	38.97	42.22
Senior	43.99	44.88	39.01	44.33	49.15	46.86	43.79
Total terms enrolled in DE							
1 term	27.37	25.15	39.92	23.97	34.38	29.68	22.66
2-4 terms	67.20	69.04	56.81	70.02	61.43	65.42	71.03
> 5 terms	5.43	5.81	3.27	6.02	4.19	4.90	6.31
Total DE credits completed							
1-5 credits	22.52	20.32	34.93	18.09	25.79	21.28	17.70
6-11 credits	37.64	37.22	39.99	36.86	42.31	38.88	36.71
>12 credits	39.84	42.46	25.08	45.04	31.90	39.84	45.59
College transfer credits completed	70.25	75.54	40.42	77.91	57.02	62.17	82.86
Did not attempt college transfer	29.75	24.46	59.58	22.09	42.98	37.83	17.14
0 credits	0.75	0.54	3.05	0.44	1.55	1.22	0.26
1-5 credits	18.88	17.59	32.46	16.82	25.80	22.36	15.62
6-11 credits	42.84	43.03	40.82	42.90	44.44	42.17	43.38
>12 credits	37.53	38.85	23.67	39.84	28.21	34.25	40.74
CTE credits completed	61.06	58.12	77.63	57.01	66.78	68.97	52.18
Did not attempt CTE	38.94	41.88	22.37	42.99	33.22	31.03	47.82
0 credits	1.00	0.99	1.04	0.96	1.16	0.92	1.04
1-5 credits	33.39	31.78	40.14	30.96	37.29	31.57	31.94
6-11 credits	47.37	48.80	41.37	49.22	45.96	49.02	48.64
>12 credits	18.24	18.43	17.44	18.86	15.59	18.50	18.39

Independent Variables	Total	Dependent Variables: Enrollment in College		Timing of Enrollment		Institutional Type	
		Enrolled	Did Not Enroll	Immediate	Delayed	2-year	4-year
	N = 18,862	*n* = 16,019	*n* = 2,843	*n* = 14,204	*n* = 1,815	*n* = 5,668	*n* = 10,351
GPA							
< 2.49	17.50	14.86	32.33	13.31	27.00	22.35	10.76
2.50-2.99	11.82	11.97	10.94	11.93	12.34	13.18	11.31
> 3.00	70.69	73.16	56.74	74.76	60.66	64.47	77.92
Award							
CSC	0.54	0.48	0.88	0.44	0.83	0.81	0.30
Certificate and/or Degree	1.56	1.68	0.88	1.80	0.72	0.51	2.32
No Award	97.90	97.84	98.24	97.76	98.46	98.68	97.38

Note. Students who did not attempt any credits in a particular credit type are not included in the percentages for that credit type. Students may have attempted credits in one or both credit types, and completed 0 credits in one credit type.

institutions of higher education, or across the nation, which might explain, at least in part, the higher college-going rates of Virginia DE students.

Table 45

Summary of College Enrollment Rates Overall and of Select Student Demographics for Comparison to Virginia DE

	Virginia DE	VCCS[a]	State[a]	National[b]
Overall	85%	53%	64%	68%
Gender				
Female	55%	57	57%	57%
Male	45%	43	43%	43%
Race/Ethnicity				
White	74%	61%	66%	58%
African American	13%	22%	19%	14%
Hispanic	4%	8%	6%	13%
Other minorities	9%	9%	9%	15%

[a]State Council of Higher Education for Virginia. (2017a). *E22: Fall headcount: Trends in race ethnicity* [Annual enrollment report]. Retrieved from http://research.schev.edu/enrollment/E22_report.asp.
[b]U.S. Department of Education, National Center for Education Statistics. (2014b). Table 306.10: Total fall enrollment in degree-granting postsecondary institutions, by level of enrollment, sex, attendance status, and race/ethnicity of student: Selected years, 1976 through 2013. In U.S. Department of Education, National Center for Education Statistics (Ed.), *Digest of Education Statistics* (2013 ed.). Retrieved from https://nces.ed.gov/programs/digest/d13/tables/dt13_306.10.asp.

In terms of race/ethnicity enrollment patterns, students who enrolled in college were predominately non-minority, or White, similar to the overall participation in Virginia DE. Non-minority students accounted for 74% of DE students who enrolled in college, which is a larger proportion of non-minority students than are enrolled at Virginia's Community Colleges (61%; SCHEV, 2017a), all undergraduates in Virginia (66%; SCHEV, 2017a), and all undergraduates across the nation (60%; USDOE, NCES, 2014b). Given that minority students are not participating in Virginia DE at the same rate

as their non-minority counterparts, it might be less surprising that these students are also enrolling in college at lower rates than their non-minority counterparts. However, the college-going rate of minority students overall is higher than the college-going rate of minority DE students, which presents a quandary. On the one hand, DE has the potential to help a broad range of students transition into college. On the other hand, the data show that minority students participating in Virginia DE have lower college-going rates compared to minority students not taking DE courses in the state.

African Americans and Hispanics made up a larger percentage of DE students who did not enroll in college than who did enroll, 16% and 6% compared to 13% and 4%, respectively. These data points are a bit surprising given the dramatic increase (58%) in enrollment of Hispanic students at Virginia's Community Colleges between 2008 and 2013 (VCCS, 2014), a period of time that overlaps with the current study's timeframe. The rise in college enrollment of Hispanic students juxtaposed with lower college enrollment rates of Hispanic DE students suggests that these students are not coming to Virginia's Community Colleges or other institutions of higher education by way of Virginia DE.

The timing of enrollment in college also revealed similar college-going patterns for traditionally underserved students. Of DE students who delayed enrollment in college, a greater proportion were African American (18% compared to 13% who immediately enrolled), Hispanic (7.5% compared to 4%), first generation (19% compared to 13%), and graduated from high schools in which 50% or greater of the student population received free and reduced-price lunch (26% compared to 21%).

Another difference in the composition of DE students who enrolled in college compared to non-college enrollers exists with first generation college students. Here the difference is even greater than with race/ethnicity, as only 14% of DE students who enrolled in college were first generation students, but 24% of those who did not enroll in college were first generation. According to the National Center for Education Statistics (NCES), 34% of undergraduate students in 2011-12 were classified as first generation college students (as cited in Postsecondary National Policy Institute [PNPI], 2016), whereas only 14% of Virginia DE students who went to college were first generation. First-generation students are not participating in DE relative to the number who ultimately attend college. In Virginia, these students are not taking advantage of the potential of DE to aid in the transition to college. For those first generation college students who do participate in Virginia DE, they are no more likely to enroll in college than first generation college students who did not participate in DE.

Differences in enrollment across institutional type are also illustrated here. Female DE students were more likely to enroll in a four-year institution, along with African Americans and students from high schools with a lower percentage of free and reduced-price lunch participation. This trend is reversed for Hispanics, first generation students, and those who first enrolled in DE between the ages of 18 and 20—and assumed to be older high school graduates—who were more likely to enroll in a two-year institution. These latter trends are not surprising as community colleges traditionally enroll greater proportions of minority, first generation, and older students (Cohen et al., 2013; Malcom, 2013). However, the interesting exception to these college enrollment trends is for African American students who enrolled in four-year institutions at a rate

higher rate than their enrollment in two-year institutions. A possible reason for this finding is the option for African American students to attend a Historically Black College or University (HBCUs) in Virginia, all of which are four-year institutions.

Taken together, these data points tell us that Virginia DE is not attracting a diverse student population, which creates a missed opportunity for these students. Virginia DE is not changing the college-going behaviors for students from a broad range of backgrounds and most likely, those students who could benefit most from an early college experience.

Academic metrics and college enrollment. There was the potential for differences in college enrollment rates to be attributed to some level of commitment (e.g., first term enrolled in DE, number of terms enrolled in DE), success (e.g., number of DE credits attempted, number of DE credits completed, GPA in DE), or even intensity of DE coursework (i.e., total number of DE credits attempted divided by the maximum number of total DE credits attempted per high school). Therefore, academic metrics were included in this study and indicated that DE students who enrolled in college were different in terms of their academic metrics.

Timing of first enrollment in DE courses influenced college-going decisions. A larger percentage of freshmen and sophomores who took DE courses in high school did not enroll in college, which is rather unexpected given the assumption that the earlier the exposure to college the better the enrollment outcome. Starting DE as a high school freshman was also associated with delayed enrollment, and sophomores were fairly evenly distributed between immediate and delayed enrollers. On the surface, these college enrollment patterns might point to matters of college readiness; however, the

Virginia plan appears to address college readiness with the requirement that students must complete "institutional placement criteria" (i.e., college placement exam; VCCS, 2008, p. 2), a measure of the student's readiness for college-level coursework. Rather than a concern with college readiness, what might be occurring is a lack of structure in the college course-taking patterns of community college students in general and DE students in particular (Bailey et al., 2015). As Bailey and colleagues (2015) explain, "'à la carte' course-taking can help students understand what might be expected of them in a typical college classroom, [but] it may not do much to help them develop goals or enter a specific college-level program of study" (p. 141). Not having a more structured curriculum, or guided pathway, in place has implications for the college-going behaviors of early DE course takers.

This study found that DE students who enrolled for only one term in DE were less likely to enroll in college and for those who did enroll in college, they were more likely to delay enrollment and more likely to enroll in a two-year institution. Students who are uncertain of their specific college or career pathway might elect to explore their options in a two-year institution where they have flexibility with year-round enrollment and fewer eligibility requirements for admissions (Cohen et al., 2013), which might be the case with these short-term DE students. Students with more DE credits (between 12 and 17 credits) were more likely to enroll immediately in college. Given that a higher range of credits (i.e., 12 or more) has been associated with academic momentum leading to college enrollment and college completion (Adelman, 2006; Swanson, 2008), the data here further support the threshold of completing 12 or more DE credits, even more so than the length of time students were enrolled in DE (i.e., number of terms enrolled), as

leading to greater rates of college enrollment, immediate enrollment, and enrollment in four-year institutions.

For the sample of DE students, higher academic performance, as measured by GPA in DE coursework, was associated with higher rates of college enrollment, immediate enrollment, and enrollment in four-year institutions. Distinctions in the timing of enrollment and institutional type become more apparent in the grouping of GPAs into ranges. For example, a greater portion of students earning less than a 2.50 GPA delayed enrollment (27%) than immediately enrolled (13%). This trend is also seen in institutional type for which 22% of students enrolling in a two-year institution earned less than a 2.50 GPA whereas only 13% of students enrolling in a four-year institution earned less than a 2.50 GPA. With lower admission requirements for community colleges, it is expected that students with lower GPAs might, at least initially, enroll in a two-year institution. These differences in GPA and college enrollment might also be indicative of the level of academic preparedness of these students.

The data also indicate variations in GPA across race/ethnicity and first generation status. In Table 46, I summarized the ranges of GPA across each race/ethnicity and first generation status, illustrating the disproportionate share of minority and first generation students earning lower GPAs in DE coursework. Another point of interest here is that African American DE students earned lower GPAs and were more likely to enroll in four-year institutions, while Hispanic DE students earned higher GPAs and were more likely to enroll in two-year institutions. Potentially, these differences could be explained by the availability, or lack thereof, of financial resources and information needed to attend college. Enrollment in four-year institutions introduces the opportunity for athletic

participation, and among minority students, more African Americans are awarded athletic scholarships (Kantrowitz, 2011). Enrollment in two-year institutions allow students to remain close to home, which, culturally, might be an attractive option for Hispanic students to maintain family relationships and responsibilities (Hurtado, Carter, & Spuler, 1996) and who have limited information on other college opportunities (Torres, Reiser, LePeua, Davis, & Ruder, 2006).

Table 46

Grade Point Averages of Virginia DE Students by Selected Student Demographics

	< 2.49 GPA		2.50-2.99 GPA		> 3.00 GPA	
	n	%	*n*	%	*n*	%
Race/Ethnicity						
African American	721	27.88	390	15.08	1,475	57.04
American Indian/Alaskan	15	19.48	8	10.39	54	70.13
Asian	60	9.88	44	7.25	503	82.87
Hawaiian/Pacific Islander	6	15.00	3	7.50	31	77.50
Hispanic	185	21.09	92	10.49	600	68.42
White	2,161	15.63	1,582	11.44	10,081	72.92
Not Specified	152	17.86	110	12.93	589	69.21
First Generation						
Yes	639	22.12	343	11.87	1,907	66.01
No	2,661	16.66	1,886	11.81	11,426	71.53

Students who took DE classes later in high school, acquired between 12 and 17 credits, and had GPAs in the DE courses above 2.50 were more likely to go immediately to college and most often enrolled in a four-year college. Despite the evidence of academic ability in DE courses, Hispanics did not attend college at rates similar to their White peers and most often opted for a community college versus a four-year college. This finding indicates the need for more support regarding college options for Hispanics in particular. The data show, here in Virginia, there is potential to improve DE

participation rates of underserved students and better assist them in continuing their postsecondary education after high school graduation.

The multi-level analysis indicated that the way DE students take advantage of the opportunity for DE, as measured by the rate of intensity (i.e., total number of DE credits attempted divided by the maximum number of total DE credits attempted per high school), seems to matter in whether a student will continue postsecondary education. However, it was surprising that the rate of success (i.e., total number of DE credits completed divided by total number of DE credits attempted) was not statistically significant. Both results may suggest motivational factors that are beyond the scope of the current study.

With a major benefit of DE programs being the opportunity to prepare students for the academic rigors of college coursework and to socialize the role and expectations of a college student (Barnett & Stamm, 2010; Kanny, 2015; Karp, 2012; Karp & Jeong, 2008), these programs can offer valuable early college experiences for high school students, particularly those students who are unfamiliar with college life and underserved in higher education today. Yet, these student populations are not realizing the benefits of Virginia DE because they are either not participating in the DE program or for those who are taking DE in high school, they are not continuing their postsecondary education after high school graduation or are delaying enrollment. Students who delay college enrollment are at risk for not completing college (Adelman, 2006; Bozick & DeLuca, 2005), and the current study found that Virginia DE students most likely to delay enrolling in college were minority students, were first generation college students, and attended schools with higher rates of free and reduced-price lunch—all risk factors for

not completing college in addition to delaying enrollment. Again, this finding reveals a missed opportunity to retain these underserved students from one semester to the next (i.e., as a high school DE student the semester before high school graduation to college student the following semester), a key indicator of student success and college completion (Karp et al., 2007; Perna & Thomas, 2006).

In order to gain a better understanding of the underlying reasons for these college enrollment trends and then, to devise appropriate next steps, engaging institutional agents will be necessary. In the literature and in practice, institutional agents are individuals in positions of status or authority who are able to provide students "key forms of social and institutional support" (Stanton-Salazar, 2011, p. 1075), such as resources, opportunities, privileges, and services. It is primarily through institutional agents that DE students build the appropriate connections and information networks to prepare them for access to and success in college (Dowd, Pak, & Bensimon, 2013; Stanton-Salazar, 2011). Therefore, the role of institutional agents in bridging the gap in postsecondary educational access and success for diverse student groups is paramount.

Dual pathways for DE. Virginia's DE model offers two primary pathways for DE students—college transfer and CTE—and college enrollment patterns are distinguished along these two pathways. College transfer programs facilitate the transfer of students to a four-year institution in pursuit of a baccalaureate degree (VCCS, 2017a). Career/technical education programs can be completed in two years or less and may lead to other certificate and degree programs or gainful employment in technical and occupational fields (VCCS, 2017a). Therefore, students who complete college transfer credits are expected to enroll in college while the postsecondary educational pathways for

students who complete CTE credits are less certain because these students may or may not require additional postsecondary education. As shown in Table 44, 60% of DE students who did not enroll in college did not attempt any college transfer credits, meaning they only completed CTE credits. The inverse is true for DE students who only completed college transfer credits. Only 22% of DE students who did not enroll in college did not attempt any CTE credits. These results are expected for DE students because the CTE pathway in Virginia provides the education and training needed for middle-skill jobs—those jobs requiring some education beyond high school, but not necessarily a bachelor's degree (Hughes et al., 2005; Karp et al., 2007; National Skills Coalition, 2014). Therefore, additional education may not be required of these CTE DE students. Also, DE students who completed CTE credits and enrolled in college were more likely to enroll in a two-year institution, again falling in line with the college and career pathway for CTE. Further, as the data illustrate, DE students who completed college transfer credits were more likely to immediately enroll and enroll in a four-year institution, a likely outcome given the college transfer pathway.

The distinction between the pathways for college transfer and CTE is also reflected in the postsecondary educational outcomes for DE students who earned a community college award before graduating from high school. Dual enrollment students who earned a certificate, associate degree, or both were more likely to enroll in college, enroll immediately, and enroll in a four-year institution. These DE students also completed more college transfer courses. These results are expected because certificate and associate degree programs are a part of college transfer pathways that likely require additional postsecondary education. On the other hand, DE students who completed a

CSC were more likely to delay enrollment and enroll in a two-year institution. Although the reason for delayed enrollment for CSC earners cannot be easily ascertained from the data analyzed in the current study, enrollment in a two-year institution aligns with expectations since the CSC is designed to prepare students for entry into the workforce and/or for certificate, diploma, and degree programs that ultimately lead to gainful employment (VCCS, 2017a).

Dual pathways and student demographics. Looking at selected student demographics (i.e., race/ethnic categories and first generation status) revealed differences in the college and career pathways for different student groups. In this study, the average number of college transfer credits completed by the sample of DE students was greater than the average number of CTE credits for each student group. The difference in course taking patterns suggests that White students and non-first generation students were on a pathway more likely to lead to college (i.e., college transfer pathway), while Hispanic students take a slightly different pathway. Again, the opportunity for policymakers and educators to better serve diverse student populations through DE becomes apparent as the traditional DE model in Virginia currently falls short in leveraging DE for minority students.

This deeper analysis helps explain that some of the difference in college enrollment rates among students of different race/ethnicity and income level is attributable to the type of credits completed and the type of community college award earned. In Virginia, both credit type and award signify a DE student's college and career pathway as either college transfer or CTE. This research informs policymakers and educators of the divergent pathways of DE students from different ethnic, academic, and

economic backgrounds, and also helps identify these students so that targeted strategies can be deployed to better assist them with their decisions about college and career pathways.

School-level characteristics and college enrollment. The introduction of school-level characteristics provided a better way to predict college enrollment. In addition to student habitus influencing the college-going behaviors of Virginia DE students, characteristics of a student's high school (e.g., type, size, locale, and participation in free and reduced-price lunch program) were also indicative of college enrollment. Virginia DE students who graduated from a private high school, a large high school, a high school located in close proximity to a populous area (i.e., urban), and one with a lower percentage of participation in free and reduced-price lunch program (i.e., higher income) were more likely to enroll in college. These results are supported by previous research exploring factors related to college enrollment (e.g., Hahn & Price, 2008; Kinzie et al., 2004).

This additional level of analysis further substantiates the previous results, strengthening this study's findings that Virginia DE attracts and retains non-minority students from more affluent backgrounds, as measured by the collection of student demographics and school-level characteristics. For smaller high schools, rural high schools, and those with more recipients of free and reduced-price lunch, Virginia DE has the greatest opportunity to better serve students who are less likely to enroll in college, providing them with early college experiences and the necessary information to make better decisions about postsecondary education. It is at this juncture that the VCCS can continue to do business as usual with its current, traditional model of DE or expand

Virginia DE to attract and retain a broader range of students. Following, I offer recommendations for practice, policy, and future research to reduce the gap in DE participation and subsequent college enrollment of diverse students in Virginia.

Implications for Practice, Policy, and Future Research

Through this research, I sought to gain a better understanding of Virginia DE students, specifically in terms of their demographics, academic metrics, and enrollment in college. Situating the study in Virginia helped to build a context for the statewide DE program that is delivered by Virginia's 23 community colleges and provided a single policy framework, common data elements, and similar programmatic structures. The results of the research demonstrated positive outcomes in college enrollment and immediate enrollment for the majority of students in the 2012 cohort. The data also showed DE students pursuing a college transfer pathway enrolled in four-year institutions, a likely outcome for college transfer students. Analysis found that the portrait of a DE student was largely White, non-first generation, high performing academically, and from families with high income, and thus, assumed to be students who were likely to go to college.

This portrait of DE students and their chosen college pathway illustrates that the opportunity to take college credits while in high school through Virginia DE does not reach minority students, first-generation students, or low income students compared to their White peers who are more often from higher income families with college-going experience. Because Virginia DE does not attract as diverse of a student body as the community college system and/or other institutions of higher education throughout the state and nation, this program misses the opportunity to make a difference in the college

enrollment rates of underserved student populations and/or to change the academic preparedness of these students. Here I offer recommendations that could help leverage Virginia DE as a mechanism for improving the college enrollment and completion rates of underserved student populations.

Implications for practice. The prospect for Virginia DE to better serve underserved student populations and broaden participation in DE is evident in the ways in which these programs promote access to and success in college (An, 2013; Bailey & Karp, 2003; Cowan & Goldhaber, 2015; Pretlow & Wathington, 2014; Roach et al., 2015; Taylor, 2015). The need for expanding DE to these students is evident in their low participation rates in DE and college enrollment. Further, what is already known about helping these students access and succeed in postsecondary education can also be incorporated into an expanded model for Virginia DE. Specifically, I recommend expanding Virginia's DE model to include an additional pathway for college readiness, and strengthening the existing college transfer and CTE pathways. By adding a pathway to college readiness for prospective DE students, the Virginia DE model could better prepare students for either a college transfer or CTE pathway and provide the additional academic, financial, and social supports needed by all students to be successful. Clearer and stronger college and career pathways could help students from a wide range of academic and economic backgrounds better understand, assess, and select their options for postsecondary education and training, and ultimately, entry into the workforce.

Pathway to college readiness. Expanding the current DE model to include an additional pathway to college readiness could help broaden the audience for Virginia DE by allowing students who are uncertain of their college and career plans and/or not quite

ready for the rigors of college coursework (i.e., based on college placement test scores) to participate in some level of DE coursework (e.g., CTE) and other college preparatory activities. Currently, general college enrollment rates of underserved student populations (e.g., minority students, first generation, and low income) are greater than DE participation rates of these same student populations. This means that students in need of additional supports to navigate the higher education system are enrolling in college after high school graduation without taking advantage of early exposure to college while in high school. Participation in DE could assist students—particularly those from traditionally underserved in higher education—with the transition from high school to college, better preparing them for success and completion in college (Barnett & Stamm, 2010; Jobs for the Future, 2006; Kanny, 2015; Karp, 2012, 2015; Karp & Jeong, 2008).

The Virginia model restricts participation in DE to high school students who have demonstrated a certain level of college readiness (VCCS, 2008). Given that DE courses are actual college courses, this eligibility requirement is reasonable. As a result, however, the student population participating in DE appears to be those students who were most likely academically-prepared and on their way to college anyway. Because DE programs can be leveraged to assist a broader range of students to prepare for success in college in more ways than simply providing the opportunity to complete college credits in high school (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett & Stamm, 2010; Barnett et al., 2015), the purpose of Virginia DE could be expanded to better serve all students.

Several program models, such as early and middle college (outlined in Chapter 2), have demonstrated their value in helping underserved student populations prepare for

success in college. Two program features in ECHSs and MCHSs differentiate them from other DE program models: structured (or sequenced) curriculum and targeted student support services. Much like the primary institutions delivering them, DE programs are providing a great deal of choice for college coursework, but with little to no guidance about an appropriate strategy for applying college credits to a specific college or career pathways (Jenkins, 2014). Also, the pathways are not always clearly defined and/or the end goals remain unclear (Jenkins, 2014). Early and middle college high schools help eliminate these issues by structuring the DE curriculum so students complete a certain level of credits that can be readily applied for college transfer and/or entry into the workforce (Abell Foundation, 2007; Bailey & Karp, 2003; Barnett et al., 2015). Further, a suite of comprehensive support services, such as financial aid, tutoring, advising, and career development, better support students through completion of DE programs (Barnett et al., 2015).

For some, the flexibility of community college programs and course-taking is appealing because it allows students the opportunity to explore their college and career aspirations before committing to a particular pathway. However, the lack of structure enables students to take an assortment of college credits that may not be applicable to a particular area of study (Bailey et al., 2015). Students who complete high school with a bucket of college credits may not be any better prepared to enter a program of study, which undermines the value of DE programs. A more structured curriculum in Virginia DE would help ensure students are taking the right courses and in an appropriate sequence to help maximize their success in college.

In addition to more structure around the courses taken in DE, some students require additional academic, financial, and social supports. Providing targeted student support services such as advising, career counseling, financial aid workshops, tutoring, and other opportunities to develop college success skills, could help bridge the gap for students from diverse backgrounds with little to no early exposure to college. These students are in need of guidance to help them navigate postsecondary education systems, understand college and career options, and encouragement along the way, features largely missing from the current model for Virginia DE.

John Tyler Community College is currently piloting an early college academy (https://www.jtcc.edu/academics/tyler-early-college-academy/), which provides a structured curriculum and targeted student services for students in most need of assistance. The application process for prospective students includes completion of the college placement exams to determine college readiness. Based on the student's exam score, he/she will either be fully admitted into the program or provisionally admitted with the opportunity to complete college preparatory coursework and remediation to prepare students for college-level coursework. The data from the pilot should indicate whether the program is effective in moving students who were not quite college ready into college readiness and on the pathway to earn a postsecondary education credential upon high school graduation.

Similar to the academy at John Tyler, the expanded model for Virginia DE could consider multiple tracks for students who might be interested in pursuing a college education, but are not quite ready for college-level coursework while in high school. Students could be admitted to DE provisionally until they have demonstrated

improvement in their college placement test scores and/or completed college preparatory coursework. These opportunities might open the door to DE for students from a broad range of academic backgrounds and give them the opportunity to become college ready prior to high school graduation.

From the data, we consistently see African American, Hispanic, and first generation DE students not realizing the benefit of DE as fully as White and non-first generation DE students and the overall sample of DE students. An initial pathway to college readiness could help identify these students who might not make the first cut for placement in college-level coursework, but with the opportunity to complete college preparatory courses and activities could be given the opportunity to become college ready, improve college placement test scores, and be ready for higher level DE courses prior to graduating from high school.

Strengthening college transfer and CTE pathways. Previously, I outlined two pathways offered in Virginia DE: college transfer and CTE. Traditionally, college transfer courses facilitate the transfer to a four-year institution, while CTE prepares students for the workforce and/or additional postsecondary education and training. Yet, the data made it clear that the college transfer pathway and CTE pathway have different college enrollment outcomes with more college transfer DE students enrolling in college than CTE DE students. Although the VCCS policy manual differentiates between these two pathways as serving two distinct purposes, many DE students take courses in both pathways. Given that these results differ from other state DE programs, namely Florida where CTE students were more likely to enroll in college, there is an opportunity to

strengthen these two pathways to help guide students in understanding their options and achieving their educational goals (Jenkins, 2014).

Several advantages to offering CTE as a DE pathway have been discussed in the literature. Hughes et al. (2005) concluded that the prestige and rigor of CTE programs could be enhanced when CTE is offered as a DE program. Further as CTE college students, students are given access to important college support services, such as tutoring, advising, career counseling, and library facilities. A potential disadvantage for CTE DE is the student eligibility requirements being the same for students entering either pathway. Better information about these pathways, the distinction between the two, the requirements for both, and the support to prepare for either pathway, could become key program features of an expanded model of DE in Virginia.

From the current research, it is clear that Virginia DE could be expanded to better attract and serve students from underserved populations. By offering an additional DE pathway that allows students who might not yet be ready for college to complete college preparatory courses and activities to help them become college ready, might open the door for students from diverse backgrounds. Consideration of the program structures that prohibit participation in DE, and ultimately enrollment in college, need to be explored. Similarly, providing DE courses at low to no cost for low-income students might also help this subgroup find participation in DE to be a more affordable option.

Implications for policy. The current model for Virginia DE is a fairly traditional model of DE that falls under the singleton typology of credit-based transition programs (Bailey & Karp, 2003), as described previously. Yet, at the intersection of the need for postsecondary education and training beyond high school, the vision for Virginia's

Community Colleges to see a college graduate in every Virginia household (VCCS, 2016), and a statewide policy framework for DE partnerships with the community colleges and public school system, the Virginia DE model could be strategically leveraged to prepare an educated and skilled workforce of diverse individuals. Understanding that there are already some DE programs that offer more comprehensive services (e.g., structured or sequenced curriculum and targeted support services), the policy for Virginia DE should be revised to better leverage the opportunity for DE to bridge the postsecondary educational gap for underserved student populations. As similar programs have demonstrated, Virginia's current model of DE could be expanded to deliver additional college support services for program participants and to better attract and retain a broader range of students. By articulating a clear purpose for an expanded DE model, using metrics to measure progress, outcomes, and opportunities for continuous improvement; and committing resources and empowering people, Virginia DE could maximize program outcomes for a broad range of students and better meet the state's growing need for an educated and skilled workforce.

Several policy levers can expand DE opportunities to a wide range of students. In Oklahoma, a DE pilot program was designed specifically to eliminate barriers for low-income, first-generation, and minority students through policy changes (Roach et al., 2015). The pilot program was implemented after exemptions to an existing policy—primarily student eligibility requirements and tuition waivers—were granted. Although student eligibility requirements are not as strict in Virginia, college readiness (i.e., college placement exam score) is a primary factor for determining who participates in DE, which may exclude some high school students who have the potential to become college ready

through participation in DE. As I outlined previously, one strategy for mitigating the potentially negative effect of the current policy's requirement for demonstrated college readiness is offering a targeted approach to help prospective DE students become college ready.

Another policy lever for broadening access to DE and its respective benefits is through financial structures. Students who are unable to afford DE might be the ones most in need of the opportunity to participate in early college experiences. Yet, the cost of college while in high school prices them out of the DE model. Not only does the cost of postsecondary education keep these students from participating in DE, but it might also keep them from pursuing education or training after high school graduation because of the perceived and actual costs. Most likely, students who are unable to afford DE in high school are likely eligible for financial aid for college after high school graduation. Yet without the opportunity to engage in early college experiences, these students are no better off once they arrive to college with access to financial aid than they would have been had they been able to participate in DE prior to high school graduation. An expanded model of Virginia DE with better financing options for DE (e.g., discounted or free tuition for low-income students) could help address these barriers.

The Virginia Plan indicates the value of DE is the opportunity for students to earn college credits, enriching the high school curriculum and improving college enrollment rates (VCCS, 2008). However, the policy is fairly silent on the opportunity for DE to expand access to postsecondary education for underserved student populations. Taylor (2013) found a similar issue in Illinois, concluding that "the fact that Illinois' 2002-2003 dual credit policy did not articulate a goal of increasing access and outcomes for

underserved students, might explain, at least in part, why inequitable outcomes emerged in this study" (p. 198). Although this research found similar inequities in college enrollment patterns across diverse student groups, the overall college enrollment rate for Virginia DE students has improved in the last several years. In times of greater demand for postsecondary education and training and for a more diverse student body of college graduates, diversifying Virginia DE indicates the potential to prepare a more diverse, educated workforce.

Implications for future research. The results from this research offer several opportunities for additional inquiry and investigation. Leaders, educators, and policymakers will need to continue to collect and analyze DE data, explore qualitative research methods, and develop case studies that help them further identify and understand the institutional structures and practices most effective for optimizing DE programs. The following are recommendations for future research:

- A few of the data limitations for the current study point to opportunities for future research that use potentially better measures of student demographics such as SES and family income, or academic metrics such as high school GPA and standardized test scores. These variables could help the researcher control for preexisting characteristics that might explain differences among DE students and their postsecondary educational pathways. Further, the location where DE courses were taught was intended to be collected and analyzed for this study, but these data were not available for the timeframe of the study (i.e., 2008-2012). This information has since been collected in more recent years, and therefore an analysis of where DE students took their DE courses

(e.g., at their high school, on a community college campus, or both) might reveal differences among DE students and their patterns of college enrollment. Also, it would be interesting to explore the student experiences of DE students who took DE courses at the high school compared to those who took DE courses on the college campus. Are high school-based DE programs providing realistic early college experiences for participants? Are there differences in the student's experience and preparation for college in a high school-based versus college campus-based DE program? Are both programs appropriately and adequately socializing high school students to the expectations of the role of college student?

- Within this study, I found differences between students who were homeschooled and students who attended public and private high schools, such as the total number of credits completed. Differences among high school type were not the focus for this study, but it could be further explored in another study. Exploring the course-taking patterns of students and the types of postsecondary institutions they attend could also inform policy and practice.
- The value of DE programs extends beyond just college enrollment. However, college enrollment was the focus of the current study because, as Karp (2015) poignantly explained, students cannot graduate from college if they have not enrolled! Although the timeframe for this study was too early to explore college completion rates for the 2012 cohort of high school graduates, there will be an opportunity to study college completion, or degree attainment, of

these students in another year or so. Using a similar set of variables included in this study, future research could explore differences in the completion rates of DE students based on student demographics and academic metrics variables.

- Postsecondary education and training is intended to lead to a college credential and/or gainful employment. The college and career pathways of DE students could be further investigated to understand the long-term outcomes of DE participation, such as the highest level of education completed, gainful employment, and income.
- It is possible that college completion rates of DE students are linked to the number of DE credits accepted by four-year and transfer institutions. Even though DE credits are intended to be applied to the student's degree program, further research is needed to understand which credits are actually accepted by other postsecondary institutions and whether they are accepted as general education credits and/or program major credits. This research could also yield valuable information regarding time-to-completion and potential cost savings for students who started their college coursework while in high school.
- The subject area for DE credits taken by students while in high school might also be a factor influencing which DE credits are accepted by other postsecondary institutions. In this study, DE credits were categorized as college transfer or career/technical education credits. A deeper examination of subject areas and course topics, however, could provide a greater understanding of DE students' preparation for postsecondary education. Also,

the specific courses taken while in high school might reveal variations between college goers and non-college goers.

- Although the majority of DE students enrolled in college, a small portion did not enroll within three years after high school graduation as presented in the findings for the current study. Therefore, additional investigation of these students might uncover the post-high school pathways of these DE students. For example, of those who did not enroll, did they acquire gainful employment after high school graduation? Did they enlist in the military? Did they enroll in a for-profit or proprietary institution? At what point in time, if at all, do they eventually enroll in college?
- Financing college continues to be a barrier to enrollment for some students. Future work in this area could explore whether students paid for DE credits while in high school or received DE at a discounted rate or for free. Did students participate in DE because it was offered to them at a discounted rate or for free? Do students discontinue their postsecondary pathways after high school graduation due to financial constraints?
- Due to data limitations, few studies have been able to employ more sophisticated research methods such as propensity score matching. Propensity score matching helps to reduce bias in the research as well as provides an alternative for making causal references (Rosenbaum & Rubin, 1984). Such results might better explain and predict differences in the postsecondary educational pathways of DE students compared to the methods used in the current and previous studies.

- For this study, it was important to explore student habitus (i.e., student demographics and academic metrics) of DE students. In future studies, high school and college characteristics, such as, cost, the presence of a career coach in the high school, and other available resources (e.g., tutoring, counseling, structured curriculum, etc.) could be examined to determine whether differences exist across college enrollment and/or college completion of DE students.
- Although the current study employed a quantitative research design, there are several opportunities for qualitative methods. For example, using Perna's college choice model, a case study or multiple case studies could be developed to identify and evaluate the contextual factors influencing college enrollment and/or completion of DE students. Similar to the intent with the current study, case studies could help policymakers and educators understand the factors supporting or hindering enrollment in college for DE students.
- Other methods of qualitative research could be utilized, such as narrative to tell the stories of DE students and their choice to immediately enroll, delay enrollment, or not enroll. Qualitative research could provide a better understanding of the factors influencing college choice for DE students.

Summary and Concluding Thoughts

With a rising demand for postsecondary education and training beyond high school, policymakers, administrators, and educators continue to look for opportunities to improve college access and success for all students. Community colleges play a significant role in the college access and completion agenda as they help students

transition from secondary to postsecondary education and/or entry into the workforce, namely through DE programs that provide high school students the opportunity to complete at least some postsecondary education and training before graduating from high school. This examination of student demographics, academic metrics, and college enrollment of Virginia DE students revealed differences in enrollment in college, timing of college enrollment, and the type of institution in which DE students enrolled, exposing gaps in participation in DE and differential outcomes for participants.

Overall, the data demonstrated that participants of Virginia DE experienced high enrollments in college, but the majority of these students were non-minority, non-first generation, academically high performers, and/or from families with higher income. Thus, a traditional model of DE was evident in Virginia in which high-achieving, non-minority students are given the opportunity to take a wider range of course options in high school. African American students, Hispanic students, and first generation college students participated in Virginia DE and enrolled in postsecondary education at rates lower than expected given their representation in higher education today, revealing the need to improve policy and practice to better attract and retain these students in DE. Further, credit momentum (i.e., number of DE credits completed) was associated with higher rates of college enrollment. Therefore, participation in Virginia DE helped students continue their momentum into college. Also, Virginia DE appeared to be of a greater benefit to four-year institutions since Virginia DE students were more likely to enroll in them than two-year institutions.

Because some students with DE credits did not immediately enroll in college after high school graduation, casting the issue as one of retention provides a new way to

contemplate how best to improve college-going rates for those currently opting out of higher education. Attention to academic pathways (Bragg et al., 2006), institutional agents and support mechanism (Dowd et al., 2013; Stanton-Salazar, 2011), and student engagement (Adelman, 2006; Corwin & Tierney, 2007; Tierney et al., 2003) can provide strategies to move more DE students to college.

The leading purpose of DE in Virginia—to provide a wider range of course options for high school students in academic, career/occupational-technical subject areas—seems only to preserve institutional structures that help high-achieving college-bound students pursue their postsecondary education after high school graduation. Unfortunately, these structures neither demand nor support students from a variety of academic and economic backgrounds to participate in DE, and thus, undermine the potential impact of Virginia DE on college enrollment and completion. Similar to the paradigm shift from access to success with community colleges, DE can no longer be just about providing high school students the opportunity to enroll in college prior to high school graduation. Rather DE has the potential to help all students achieve success in postsecondary education and training. The research presented here equips policymakers and educators to position Virginia DE as a leading strategy for improving access to and success in college for a broad range of students.

Appendix

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